Rules and Regulations for the Construction and Classification of Floating Docks and Dock Gates

July 2021

Lloyd's Register

A guide to the Rules

and published requirements

Rules and Regulations for the Construction and Classification of Floating Docks and Dock Gates

Introduction

The Rules are published as one volume. A comprehensive List of Contents is placed at the beginning.

Rules updating

The Rules are generally published annually and changed through a system of Notices between releases.

Rules programs

LR has developed windows based Rules Calculation Software which evaluates Rule Requirements for Special Service Crafts' structures. For details of this software please contact Lloyd’s Register.

Direct calculations

The Rules may require direct calculations to be submitted for specific parts of the ship structure or arrangements and these will be assessed in relation to LR’s own direct calculation procedures. They may also be required for ships of unusual form, proportion or speed, where intended for the carriage of special cargoes or for special restricted service and as supporting documentation for arrangements or scantlings alternative to those required by the Rules.

July 2021

PART 1 REGULATIONS

CHAPTER 1 GENERAL REGULATIONS

CHAPTER 2 CLASSIFICATION REGULATIONS

CHAPTER 3 PERIODICAL SURVEY REGULATIONS

PART 2 RULES FOR CONSTRUCTION

Section
1 **Background**

2 **Governance**

3 **Technical Committee**

4 **Naval Ship Technical Committee**

5 **Applicability of Classification Rules and Disclosure of Information**

6 **Ethics**

7 **Non-Payment of Fees**

8 **Limits of Liability**

■ *Section 1* Background

1.1 Lloyd's Register Group Limited is a registered company under English law, with origins dating from 1760. It was established for the purpose of producing a faithful and accurate classification of merchant shipping. It now primarily produces classification Rules.

1.2 Classification services are delivered to clients by a number of other members subsidiaries and affiliates of Lloyd's Register Group Limited, including but not limited to: Lloyd's Register EMEA, Lloyd's Register Asia, Lloyd's Register North America, Inc., and Lloyd's Register Central and South America Limited. Lloyd's Register Group Limited, its subsidiaries and affiliates are hereinafter, individually and collectively, referred to as 'LR'.

■ *Section 2* Governance

2.1 Lloyd's Register Group Limited is managed by a Board of Directors (hereinafter referred to as 'the Board').

The Board has:

appointed a Classification Committee and determined its powers and functions and authorised it to delegate certain of its powers to a Classification Executive and Devolved Classification Executives;

appointed Technical Committees and determined their powers, functions and duties.

2.2 LR has established National and Area Committees in the following:

Countries:	Areas:
Australia (via Lloyd's Register Asia)	Benelux (via Lloyd's Register EMEA)
Canada (via Lloyd's Register North America, Inc.)	Central America (via Lloyd's Register Central and South America Ltd)
China (via Lloyd's Register Asia)	Nordic Countries (via Lloyd's Register EMEA)
Egypt (via Lloyd's Register EMEA)	South Asia (via Lloyd's Register Asia)
Federal Republic of Germany (via Lloyd's Register EMEA)	Asian Shipowners (via Lloyd's Register Asia)
France (via Lloyd's Register EMEA)	Greece (via Lloyd's Register EMEA)
Italy (via Lloyd's Register EMEA)	

Japan (via Lloyd's Register Group Limited)
New Zealand (via Lloyd's Register Asia)
Poland (via Lloyd's Register (Polska) Sp zoo)
Spain (via Lloyd's Register EMEA)
United States of America (via Lloyd's Register North America, Inc.)

■ *Section 3* **Technical Committee**

3.1 LR maintains a Technical Committee, at present comprised of a maximum of 80 members, and additionally an Offshore Technical Committee with specific responsibility for LR’s Rules for Offshore Units, at present comprised of a maximum of 80 members. Membership of the Technical Committees includes:

Ex officio members:

- Chairman and Chief Executive Officer of Lloyd’s Register Group Limited
- Chairman of the Classification Committee of Lloyd’s Register Group Limited

Members Nominated by:

- Technical Committee or Offshore Technical Committee
- Professional bodies representing technical disciplines relevant to the industry
- National and International trade associations with competence relevant to technical issues related to LR's business

3.2 In addition to the foregoing:

(a) Each National or Area Committee may appoint a representative to attend meetings of the Technical Committees.
(b) A maximum of five further representatives from National Administrations may be co-opted to serve on the Technical Committees. Representatives from National Administrations may also be elected as members of the Technical Committees as Nominated Members.
(c) Further persons may be co-opted to serve on the Technical Committees by the relevant Technical Committee.

3.3 All elections are subject to confirmation by the Board.

3.4 The function of the Technical Committees is to consider:

(a) any technical issues connected with LR’s business;
(b) any proposed alterations in the existing Rules;
(c) any new Rules for classification;

Where changes to the Rules are necessitated by mandatory implementation of International Conventions and Codes, or Common Rules, Unified Requirements and Interpretations adopted by the International Association of Classification Societies, these may be implemented by LR without consideration by the relevant Technical Committee, although any such changes may be provided to the Technical Committees for information.

Where changes to the Rules are required by LR to enable existing technical requirements within the Rules to be recognised as Class Notations or Descriptive Notes, these may be implemented by LR without consideration by the relevant Technical Committee, although any such changes will be provided to the relevant Technical Committee for information

3.5 The term of office of the Chairman and of all members of each Technical Committee is five years. Members may be re-elected to serve an additional term of office with the approval of the Board. The term of office of the Chairman may be extended with the approval of the Board.

3.6 In the case of continuous non-attendance of a member, the relevant Technical Committee may withdraw membership.

3.7 Meetings of the Technical Committees are convened as often and at such times and places as is necessary, but there is to be at least one meeting in each year. Matters may also be considered by the Technical Committees by correspondence.

3.8 Any proposal involving any alteration in, or addition to the General Regulations, of Rules for Classification is subject to approval of the Board. All other proposals for additions to or alterations to the Rules for Classification other than the General Regulations, will following consideration and approval by the relevant Technical Committee either at a meeting of that Technical Committee or by correspondence, be recommended to the Board for adoption.

3.9 The Technical Committees are empowered to:

(a) appoint sub-Committees or panels; and
(b) co-opt to the Technical Committee, or to its sub-Committees or panels, representatives of any organisation or industry or private individuals for the purpose of considering any particular problem.

■ *Section 4*
Naval Ship Technical Committee

4.1 LR's Naval Ship Technical Committee is at present composed of a maximum of 50 members and includes:

Ex officio members:

- Chairman and Chief Executive Officer of Lloyd’s Register Group Limited

Member nominated by:

- Naval Ship Technical Committee;
- The Royal Navy and the UK Ministry of Defence;
- UK Shipbuilders, Ship Repairers and Defence Industry;
- Overseas Navies, Governments and Governmental Agencies;
- Overseas Shipbuilders, Ship Repairers and Defence Industries;

4.2 All elections are subject to confirmation by the Board.

4.3 All members of the Naval Ship Technical Committee are to hold security clearance from their National Authority for the equivalent of NATO CONFIDENTIAL. All material is to be handled in accordance with NATO Regulations or, for non-NATO countries, an approved equivalent. No classified material shall be disclosed to any third party without the consent of the originator.

4.4 The term of office of the Naval Ship Technical Committee Chairman and of all members of the Naval Ship Technical Committee is five years. Members may be re-elected to serve an additional term of office with the approval of the Board. The term of the Chairman may be extended with the approval of the Board.

4.5 In the case of continuous non-attendance of a member, the Naval Ship Technical Committee may withdraw membership.

4.6 The function of the Naval Ship Technical Committee is to consider technical issues connected with Naval Ship matters and to approve proposals for new Naval Ship Rules, or amendments to existing Naval Ship Rules. Where appropriate, Naval Ship Technical Committee may also recognise alternative LR Rule requirements that have been approved by the other Lloyd’s Register Technical Committee as adjunct to the Naval Ship Rules.

4.7 Meetings of the Naval Ship Technical Committee are convened as necessary but there will be at least one meeting per year. Urgent matters may be considered by the Naval Ship Technical Committee by correspondence.

4.8 Any proposal involving any alteration in, or addition to, the General Regulations of Rules for Classification of Naval Ships is subject to approval of the Board. All other proposals for additions to or alterations to the Rules for Classification of Naval Ships, other than the General Regulations, will following consideration and approval by the Naval Ship Technical Committee, either at a meeting of the Naval Ship Technical Committee or by correspondence, be recommended to the Board for adoption.

4.9 The Naval Ship Technical Committee is empowered to:

(a) appoint sub-Committees or panels; and
(b) co-opt to the Naval Ship Technical Committee, or to its sub-Committees or panels, representatives of any organisation or industry or private individuals for the purpose of considering any particular problem.

Section 5
Applicability of Classification Rules and Disclosure of Information

5.1 LR has the power to adopt, and publish as deemed necessary, Rules relating to classification and has (in relation thereto) provided the following:

(a) Except in the case of a special directive by the Board, no new Regulation or alteration to any existing Regulation relating to classification or to class notations is to be applied to existing ships.

(b) Except in the case of a special directive by the Board, or where changes necessitated by mandatory implementation of International Conventions, Codes or Unified Requirements adopted by the International Association of Classification Societies are concerned, no new Rule or alteration in any existing Rule is to be applied compulsorily after the date on which the contract between the ship builder and shipowner for construction of the ship has been signed, nor within six months of its adoption. The date of 'contract for construction' of a ship is the date on which the contract to build the ship is signed between the prospective shipowner and the ship builder. This date and the construction number (i.e. hull numbers) of all the vessels included in the contract are to be declared by the party applying for the assignment of class to a newbuilding. The date of 'contract for construction' of a series of sister ships, including specified optional ships for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective shipowner and the ship builder. In this section a 'series of sister ships' is a series of ships built to the same approved plans for classification purposes, under a single contract for construction. The optional ships will be considered part of the same series of sister ships if the option is exercised not later than 1 year after the contract to build the series was signed. If a contract for construction is later amended to include additional ships or additional options, the date of 'contract for construction' for such ships is the date on which the amendment to the contract is signed between the prospective shipowner and the ship builder. The amendment to the contract is to be considered as a 'new contract'. If a contract for construction is amended to change the ship type, the date of 'contract for construction' of this modified vessel, or vessels, is the date on which the revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder. Where it is desired to use existing approved ship or machinery plans for a new contract, written application is to be made to LR. Sister ships may have minor design alterations provided that such alterations do not affect matters related to classification, or if the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the ship builder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to LR for approval. Recognising the long time period that may occur between the initial design contract and the contract for construction for offshore units for fixed locations, the date determining effective classification requirements will be specially considered by LR in such cases.

(c) All reports of survey are to be made by surveyors authorised by members of the LR Group to survey and report (hereinafter referred to as 'the Surveyors') according to the form prescribed, and submitted for the consideration of the Classification Committee.

(d) Information contained in the reports of classification and statutory surveys will be made available to the relevant owner, National Administration, Port State Administration, P&I Club, hull underwriter and, if authorised in writing by that owner, to any other person or organisation.

(e) Notwithstanding the general duty of confidentiality owed by LR to its client in accordance with the LR Rules, LR clients hereby accept that, LR will participate in the IACS Early Warning System which requires each IACS member to provide its fellow IACS members and Associates with relevant technical information on serious hull structural and engineering systems failures, as defined in the IACS Early Warning System (but not including any drawings relating to the ship which may be the specific property of another party), to enable such useful information to be shared and utilised to facilitate the proper working of the IACS Early Warning System. LR will provide its client with written details of such information upon sending the same to IACS Members and Associates.

(f) Information relating to the status of classification and statutory surveys and suspensions/withdrawals of class together with any associated conditions of class will be made available as required by applicable legislation or court order.

(g) A Classification Executive consisting of senior members of LR's Classification Department staff shall carry out whatever duties that may be within the function of the Classification Committee that the Classification Committee assigns to it.

■ *Section 6* **Ethics**

6.1 No LR Group employee is permitted under any circumstances, to accept, directly or indirectly, from any person, firm or company, with whom the work of the employee brings the employee into contact, any present, bonus, entertainment or honorarium of any sort whatsoever which is of more than nominal value or which might be construed to exceed customary courtesy extended in accordance with accepted ethical business standards.

■ *Section 7* **Non-Payment of Fees**

7.1 LR has the power to withhold or, if already granted, to suspend or withdraw any ship from class (or to withhold any certificate or report in any other case), in the event of non-payment of any fee to any member of the LR Group.

■ *Section 8* **Limits of Liability**

8.1 When providing services LR does not assess compliance with any standard other than the applicable LR Rules, international conventions and other standards agreed in writing.

8.2 In providing services, information or advice, LR does not warrant the accuracy of any information or advice supplied. Except as set out herein, LR will not be liable for any loss, damage or expense sustained by any person and caused by any act, omission, error, negligence or strict liability of LR or caused by any inaccuracy in any information or advice given in any way by or on behalf of LR even if held to amount to a breach of warranty. Nevertheless, if the Client uses LR services or relies on any information or advice given by or on behalf of LR and as a result suffers loss, damage or expense that is proved to have been caused by any negligent act, omission or error of LR or any negligent inaccuracy in information or advice given by or on behalf of LR then LR will pay compensation to the client for its proved loss up to but not exceeding the amount of the fee (if any) charged for that particular service, information or advice.

8.3 LR will print on all certificates and reports the following notice: Lloyd's Register Group Limited, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as ‘Lloyd's Register’. Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

8.4 Except in the circumstances of section *Pt 1, Ch 1, 8 Limits of Liability 8.2* above, LR will not be liable for any loss of profit, loss of contract, loss of use or any indirect or consequential loss, damage or expense sustained by any person caused by any act, omission or error or caused by any inaccuracy in any information or advice given in any way by or on behalf of LR even if held to amount to a breach of warranty.

8.5 Any dispute about LR services is subject to the exclusive jurisdiction of the English courts and will be governed by English law.

Section
1 **Conditions for classification**

2 **Surveys – General**

3 **IACS QSCS Audits**

■ *Section 1* Conditions for classification

1.1 General

1.1.1 Floating docks and dock gates built in accordance with Lloyd's Register's (hereinafter referred to as 'LR') Rules and Regulations, or with alternative arrangements equivalent thereto (*see Pt 1, Ch 2, 1.6 Equivalent arrangements*), will be assigned a class and included in the *Register Book* and will continue to be classed so long as they are found, upon examination at the prescribed Annual and other Periodical Surveys, to be maintained in a fit and efficient condition and in accordance with the requirements of these Rules.

1.1.2 Classification will be conditional upon compliance with LR's requirements in respect of both hull and machinery (i.e. boilers, pressure vessels, engines, compressors, pumping arrangements, control and electrical equipment) essential to the safety and operation of the floating dock or dock gate.

1.1.3 The Rules are framed on the understanding that floating docks and dock gates will not be operated in environmental conditions more severe than those agreed for the design basis and approval, without the prior agreement of LR.

1.1.4 Furthermore, the Rules are framed on the assumption that the operating site for a floating dock is not subjected to undue swell conditions. If this is not the case, details of the proposed site and prevailing wave, swell, current and wind conditions should be submitted for special consideration at the earliest possible stage.

1.1.5 Floating dock securing arrangements are not considered to be classification items and hence their inspection is not included in LR's Survey List. However, when requested an appraisal of these arrangements including possible Certification can be undertaken as an additional service. Notwithstanding the above, the local strength of the dock structure in way of mooring attachments is considered a classification item.

1.1.6 The Rules are also framed on the understanding that floating docks and dock gates will be properly loaded and handled; they do not, unless stated in the class notation, provide for special distributions or concentrations of loading. The Committee may also require additional strengthening to be fitted in any floating dock which, in their opinion, may be subjected to severe stresses due to particular features in the design or when it is desired to make provision for exceptional loaded or ballasted conditions. In these cases particulars are to be submitted for consideration.

1.1.7 Alternative arrangements, materials and equipment if proposed will be considered for acceptance on the basis of structural equivalency.

1.1.8 Stability aspects, vibratory performance and motion characteristics of the floating dock at site are not considered to be classification responsibility. These services may, however, be provided on a consultancy basis.

1.1.9 Stability aspects (including static stability), seal performance and fit, machinery, electrical systems, hydraulic systems, fire and safety arrangements, connections to the dock walls/entrance, slots for sliding/rolling dock gates, vibratory performance and motion characteristics of the dock gate at site are not considered to be classification responsibility. These services may, however, be provided on a consultancy basis.

1.2 Character of classification and class notation

1.2.1 Floating docks built in accordance with LR's Rules and Regulations will be eligible for assignment of the class notation:

'A' Floating dock for service at .... (port to be specified).

1.2.2 Where the port of construction is remote from the port of operation, the class will not be assigned until the dock has received a General Examination following its arrival and installation at its port of operation.

1.2.3 Dock gates built in accordance with LR's Rules and Regulations will be eligible for assignment of the class notation:

Dock gate for service at….. (location to be specified)

1.2.4 Where additional assessments, *see Pt 2, Ch 2, 5 Additional assessments*, have been carried out at the request of the Owner/Operator, dock gates will be assigned the following notation appended by one or more characters in brackets indicating the type of assessment carried out:

EDG()

F fatigue assessment
S seismic assessment
T thermal assessment
I impact assessment

1.2.5 **Special features.** When a special feature in the design or construction of a floating dock or dock gate or its machinery has been approved, an appropriate special feature notation may be entered in the *Register Book*.

1.3 Descriptive notes

1.3.1 In addition to any class notations, an appropriate descriptive note shall be entered in Column 6 of the *Register Book* indicating the type of ship in greater detail than is contained in the class notation, and/or providing additional information about the ship's design and construction. This descriptive note is not a LR classification notation and is provided solely for information.

1.3.2 **ShipRight()**. Where one or more of LR's ShipRight procedures as detailed in the *Rules and Regulations for the Classification of Ships, July 2021*, *Pt 1, Ch 2, 2.8 Descriptive notes 2.8.2* have been satisfactorily applied, then a descriptive note showing the associated characters of the procedure(s) within brackets will, at the Owner's request, be entered in column 6 of the *Register Book*, preceded by the word **ShipRight**, e.g. **ShipRight(IHM)**.

1.4 Machinery

1.4.1 The machinery, as defined in *Pt 1, Ch 2, 1.1 General 1.1.2*, is to be constructed and installed on board the floating dock in accordance with the relevant requirements of LR's *Rules and Regulations for the Classification of Ships, July 2021* (hereinafter referred to as the Rules for Ships), so far as they are applicable.

1.5 Materials

1.5.1 The materials used in the construction of hulls and machinery intended for classification, or in the repair of floating docks or dock gates already classed, are to be of good quality and free from defects and are to be tested in accordance with the requirements of LR's *Rules for the Manufacture, Testing and Certification of Materials, July 2021* . The steel is to be manufactured by an approved process at works recognised by the Committee. Alternatively, tests to the satisfaction of the Committee will be required to demonstrate the suitability of the steel.

1.5.2 Concrete materials will be specially considered.

1.6 Equivalent arrangements

1.6.1 Alternative arrangements will be permitted, provided they are considered by the Committee to be equivalent to LR's requirements.

■ *Section 2*
Surveys – General

2.1 New construction surveys

2.1.1 When it is intended to build a floating dock or dock gate for classification with LR, constructional plans and all necessary particulars of the hull and machinery, are to be submitted. (*See Pt 2, Ch 1, 1.5 Plans required* and *Pt 2, Ch 1, 1.6 Data required* for floating docks, *Pt 2, Ch 3, 1.2 Plans required* for fire safety, and *Pt 2, Ch 4, 1.4 Plans* for machinery). Proposals for any subsequent modifications or additions to the scantlings, arrangements or equipment shown on the approved plans are also to be submitted in writing and on plans for approval.

2.1.2 Where the proposed construction of any part of the hull or machinery is novel in design, or involves the use of unusual material, or where experience, in the opinion of the Committee, has not sufficiently justified the principle or mode of application involved, special tests or examinations before and during service may be required. In such cases a suitable notation may be inserted in the *Register Book*.

2.1.3 New floating docks and dock gates intended for classification are to be built under LR's Special Survey and when classed will, as appropriate, be entitled to the notation ✠ **'A' Floating Dock** or ✠ **Dock Gate**. From the commencement of the work until the completion of the floating dock, the Surveyors are to examine the materials, workmanship and arrangements. Any items found not to be in accordance with the Rules or the approved plans, or any material, workmanship or arrangement found to be unsatisfactory, are to be rectified.

2.1.4 New machinery for a floating dock classed or intended for classification is to be constructed under LR's Special Survey. The Special Survey during construction of the machinery shall relate to the period from the commencement of the work until the final test under working conditions. Any items not in accordance with the Rules or the approved plans, or any material, workmanship or arrangement found to be unsatisfactory, are to be rectified.

2.1.5 Machinery should, in principle, incorporate items which have been type tested and approved by LR. Constructional plans and particulars of approved items need not be included in submissions required by *Pt 1, Ch 2, 2.1 New construction surveys 2.1.1*.

2.1.6 The date of completion of the Special Survey during construction of a floating dock or dock gate built under LR's inspection will normally be taken as the date of build to be entered in the *Register Book*. If the period between launching and completion or commissioning is, for any reason, unduly prolonged, the dates of launching and completion or commissioning may be separately indicated in the *Register Book*.

2.2 Existing floating docks and dock gates

2.2.1 Classification of floating docks and dock gates not built under survey. The requirements of the Committee for the classification of floating docks and dock gates which have not been built under LR's survey are indicated in *Pt 1, Ch 3, 4 Classification of floating docks and dock gates not built under survey*.

2.2.2 **Reclassification.** When reclassification or class reinstatement is desired for a floating dock or dock gate for which the class previously assigned by LR has been withdrawn or suspended, the Committee will direct that a Survey appropriate to the age of the floating dock or dock gate and the circumstances of the case, be carried out by LR's Surveyors. If, at such survey, the floating dock or dock gate be found or placed in a good and efficient condition in accordance with the requirements of the Rules and Regulations, the Committee will be prepared to reinstate the original class or assign such other class as may be deemed necessary. The date of the reclassification will be recorded in the Supplement to the *Register Book*.

2.2.3 The Committee reserves the right to decline an application for classification or reclassification where the prior history or condition of the floating dock or dock gate indicates this to be appropriate.

2.3 Repairs and alterations

2.3.1 All repairs to hull and machinery which may be required in order that a floating dock or dock gate may retain class are to be carried out to the satisfaction of LR's Surveyors. When repairs are effected at a port where the services of an LR Surveyor are not available, the repairs are to be surveyed by one of LR's Surveyors at the earliest opportunity thereafter.

2.3.2 When at any survey the Surveyors consider repairs to be necessary, either as a result of damage, or of wear and tear, and repairs are not agreed by the Owner the Surveyor is to notify Southampton GTC Office immediately.

2.3.3 If a floating dock or dock gate which is classed with LR is damaged to such an extent as to necessitate towage outside port limits, it shall be the Owner's responsibility to notify LR prior to commencement of the towage.

2.3.4 Plans and particulars of any proposed alterations to the approved scantlings and arrangements of hull or machinery, are to be submitted for approval and such alterations are to be carried out to the satisfaction of LR's Surveyors.

2.4 Existing floating docks and dock gates – Periodical Surveys

2.4.1 Floating docks are to be surveyed afloat at intervals of approximately one year, in accordance with the requirements given in *Pt 1, Ch 3, 1.1 Annual surveys*.

2.4.2 Dock gates are to be surveyed at intervals of approximately one year, in accordance with the requirements given in *Pt 1, Ch 3, 1.1 Annual surveys*.

2.4.3 An examination of the underwater portion of the floating dock or dock gate is to be carried out at intervals not exceeding three years. A minimum of two examinations are to be held in each five year Special Survey Period. Consideration may be given at the discretion of the Committee to any special circumstances justifying an extension of this interval. Alternate examinations to coincide with the Special Surveys are given in *Pt 1, Ch 3, 1.2 Underwater surveys*.

2.4.4 For dock gates over 15 years of age, at least one of the examinations of the underwater portion of the dock gate in each five year Special Survey period is to be held with the dock gate out of the water. However, at the time when examination out of the water is due, the Committee may give consideration to accepting other methods of examination for the underwater portion of the dock gate, depending on the circumstances for each case. Other methods of examination are given in *Pt 1, Ch 3, 1.2 Underwater surveys*

2.4.5 Floating docks and dock gates are also to be subjected to Special Surveys in accordance with the requirements given in *Pt 1, Ch 3 Periodical Survey Regulations*, Sections *Pt 1, Ch 3, 2 Special surveys – Hull requirements* to *Pt 1, Ch 3, 4 Classification of floating docks and dock gates not built under survey*. The first Special Survey becomes due five years from the date of build and thereafter every five years from the due date of the previous Special Survey.

2.4.6 When it is inconvenient for an Owner to fulfil all the requirements of a Special Survey at its due date, the Committee will be prepared to consider its postponement, either wholly or in part, provided that LR's Surveyors are afforded an opportunity, about the due date, of assessing the general condition of the hull. For this purpose the Committee will normally call for a General Examination of the floating dock or dock gate, including Annual Survey and Underwater Survey if due or becoming due during the proposed period of postponement, of sufficient extent to be assured that its condition is satisfactory for the period of grace desired, which is not to exceed 12 months from the due date.

2.4.7 Special Surveys which are commenced prior to their due date are not to extend over a period greater than 12 months, except with the prior approval of the Committee.

2.4.8 Floating docks and dock gates which have satisfactorily passed a Special Survey will have a record entered in the Supplement to the *Register Book* indicating the date. Where a Special Survey is not completely carried out at one time, the date recorded in the Supplement will be the date at which the principal part of the requirements is complied with. Records of Special Survey will not be assigned until LR's requirements for machinery surveys are satisfactorily completed.

2.4.9 When, at the request of an Owner, it has been agreed by the Committee that the complete survey of the hull may be carried out on the Continuous Survey basis, all compartments of the hull should be opened for survey and testing in rotation with an interval of five years between consecutive examinations of each part. If the examination during Continuous Survey reveals any defects, further parts are to be opened up and examined as considered necessary by the Surveyor. Floating docks and dock gates which have satisfactorily completed the cycle will have a record entered in the Supplement to the *Register Book* indicating the date of completion.

2.4.10 For maintenance of class, the machinery, as defined in *Pt 1, Ch 2, 1.1 General 1.1.2*, is to be subjected to Periodical Surveys in accordance with the relevant requirements of *Pt 1, Ch 2 Classification Regulations* of the Rules for Ships, so far as these are applicable.

2.4.11 Complete Surveys of machinery become due five years from the date of build and thereafter every five years from the due date of the previous Complete Survey.

2.4.12 Whether or not Complete Surveys are commenced prior to their due date, they are not to extend over a period greater than 12 months without the prior approval of the Committee.

2.4.13 When it is inconvenient for an Owner to fulfil all the requirements of a Complete Survey at its due date, the Committee will be prepared to consider its postponement, either wholly or in part, provided that LR's Surveyors are afforded an opportunity, about the due date, of assessing the general condition of the machinery. For this purpose, the Committee will normally require a General Examination to be made of sufficient extent to assure them that the condition of the machinery is satisfactory for the period of grace desired, which is not to exceed 12 months from the due date. The General Examination will usually include any item which has not been surveyed for five years, together with any item in respect of which the five year interval would otherwise be exceeded during the period of postponement.

2.4.14 When, at the request of an Owner, it has been agreed by the Committee that the Complete Survey of the machinery may be carried out on the Continuous Survey basis, the various items of machinery are to be opened for survey in rotation, so far as practicable, to ensure that the interval between consecutive examinations of each item will not exceed five years. In general, approximately one fifth of the machinery is to be examined each year.

2.5 Certificates

2.5.1 When the required reports, on completion of the Special Survey of new or existing floating docks or dock gates which have been submitted for classification, have been received from the Surveyors and approved by the Committee, certificates of first entry of classification, signed by the Chairman or the Deputy-Chairman and Chairman of the Sub-Committee of Classification, will be issued to Builders or Owners.

2.5.2 Certificates of class maintenance in respect of completed Periodical Surveys of hull and machinery will also be issued to Owners on application.

2.5.3 LR's Surveyors are permitted to issue provisional (interim) certificates to enable a floating dock or dock gate, classed with LR, to operate at her specified port provided that, in their opinion, it is in a fit and efficient condition. Such certificates will embody the Surveyor's recommendations for continuance of class, but in all cases are subject to confirmation by the Committee.

2.6 Notice of surveys

2.6.1 It is the responsibility of the Owner to ensure that all surveys necessary for the maintenance of class are carried out at the proper time under the supervision of LR's Surveyors.

2.6.2 The Society will make available to an Owner timely notice about forthcoming surveys by means of a *Quarterly Listing of Surveys, Conditions of Class and Memoranda*. The omission of such notice, however, does not absolve the Owner from his responsibility to comply with LR's survey requirements for maintenance of class, all of which are available to Owners on the Class Direct website.

2.7 Withdrawal/Suspension of Class

2.7.1 When the class of a floating dock or dock gate, for which the Regulations as regards surveys on hull and machinery have been complied with, is withdrawn by the Committee in consequence of a request from the Owner, the notation 'Class withdrawn at Owners' request' (with date) will be assigned.

2.7.2 When the Regulations as regards surveys on the hull or machinery have not been complied with and the floating dock or dock gate is thereby not entitled to retain class, the class will be suspended or withdrawn, at the discretion of the Committee, and a corresponding notation will be assigned.

2.7.3 When it is found from reported defects in the hull or machinery that a floating dock or dock gate is not entitled to retain class in the *Register Book* and the Owner fails to repair such defects in accordance with LR's requirements, the class will be suspended or withdrawn, at the discretion of the Committee, and a corresponding notation indicating that class has been suspended or withdrawn because of reported defects will be assigned.

2.7.4 In all instances of class withdrawal or suspension, the assigned notation, with date of application, will initially appear in the Supplement to the *Register Book* and subsequently in the *Register Book*. In cases where class has been suspended by the Committee and it becomes apparent that the Owners are no longer interested in retaining LR's class, the notation will be amended to withdrawn status. After class withdrawn status has been established in the *Register Book* for one year, it will be automatically amended to 'classed LR until' (with date).

2.7.5 For reclassification and reinstatement of class, *see Pt 1, Ch 2, 2.2 Existing floating docks and dock gates 2.2.2*.

2.8 Appeal from Surveyors' recommendations

2.8.1 If the recommendations of LR's Surveyors are considered in any case to be unnecessary or unreasonable, appeal may be made to the Committee, who may direct a special examination to be held.

2.9 Ownership details

2.9.1 The Owner will ensure a member of the LR Group - Marine and Offshore division is promptly informed in writing of any change to their contact details and, in the event of a vessel/asset transfer or sale, is to supply details of the new Owner in writing. The new Owner is to promptly inform a member of the LR Group - Marine and Offshore division in writing of their contact details. If the new Owner fails to do so and if LR cannot verify the ownership record, then the class of that vessel/asset will be specially considered by the Classification Committee.

Section 3
IACS QSCS Audits

3.1 Audit of surveys

3.1.1 The surveys required by the Regulations may be subject to audit in accordance with the requirements of the International Association of Classification Societies' Quality System Certification Scheme.

Section
1 **Surveys**

2 **Special surveys – Hull requirements**

3 **Machinery surveys – General requirements**

4 **Classification of floating docks and dock gates not built under survey**

■ *Section 1* Surveys

1.1 Annual surveys

1.1.1 The Surveyor is to satisfy themself as to the efficient condition of the following:

Pontoon/dock gate structure, safety and top working decks, exposed inner walls, shell plating above the light waterline, supporting blocks and their foundations, casings, skylights, companionways and ladders, hatchways and manholes with their closing and securing arrangements, exposed self-docking connections, hinged gangways, arrangements and attachments for mooring, towing and lifting, air pipes and overboard scuppers and discharges, guard rails and stanchions, rubbing fenders, supporting devices, roadways and crash barriers as applicable.

1.2 Underwater surveys

1.2.1 The Owners' proposals for examination of the underwater portion of the floating dock or dock gate are to be submitted, and some combinations of the following could be used:

(a) Underwater photography.
(b) Underwater television.
(c) Diver's report.
(d) Ultrasonic gauging of plating.
(e) Careening for partial examination of bottom plating.
(f) Examination out of the water.

The extent of the examination is to be agreed, but those coinciding with Special Surveys are to be more comprehensive than the intermediate examinations. These examinations may be restricted to the parts of underwater hull which have been freed from fouling. The number, size and location of these areas are to be to the Surveyor's satisfaction.

At the time when examination of the underwater portion of dock gates is due out of water, the whole of the underwater portion is to be cleaned to enable examination; also, if alternative method/s of examination are being proposed, the proposals are to be submitted well in advance for consideration by the committee.

1.2.2 Each proposal submitted is to include a report on the conditions in which the floating dock or dock gate operates, i.e. whether fresh or salt, clear or dirty water; type of coating; whether or not cathodic protection is fitted, and any other relevant factors.

1.2.3 Seals and sealing arrangements fitted to the dock gate are to be examined to confirm their satisfactory condition. The remaining expected life of the seal is to be confirmed and seals replaced if considered necessary. Where a seal is permanently deformed, perished, has gaps or is otherwise damaged such that it no longer provides a continuous seal, it is to be replaced. Wooden seals are also to be inspected to ensure that there is no damage due to wood boring insects.

1.3 General

1.3.1 At annual and underwater surveys, the Surveyor is to examine the floating dock or dock gate and machinery (if applicable) so far as is practicable in order to satisfy himself as to their general condition.

1.4 Survey of fire equipment

1.4.1 The arrangements for fire protection, detection and extinction in floating docks are to be examined biennially. Surveys carried out by the National Authorities of the countries in which the floating dock is registered may be accepted as meeting these requirements.

1.5 Surveys for damage or alterations

1.5.1 At any time when a floating dock or dock gate is undergoing damage repairs or alterations, any exposed parts of the structure normally difficult to access should be specially examined, e.g. if any part of the machinery, including boilers, or insulation or fittings is removed for any reason the steel structure in way should be carefully examined by the Surveyor, or when concrete in the bottom or surfacing on decks is removed the plating in way should be examined before the cement or covering is relaid.

1.6 Definitions

1.6.1 **Enclosed space.** An enclosed space is any place of an enclosed nature where there is a risk of death or serious injury from hazardous substances or dangerous conditions. Examples include, but are not limited to: ballast tanks, double bottoms, double hull spaces, pump-rooms, compressor rooms, cofferdams, void spaces, duct keels, inter-barrier spaces, excavations and pits.

1.7 Preparation for survey and means of access

1.7.1 In order to enable the attending Surveyor(s) to carry out surveys, provisions for safe access and for surveys are to be agreed between the Owner and LR. Attention is drawn to the applicable recommendations in the IACS PR37 and/or IMO Recommendations For Entering Enclosed Spaces Aboard Ships, Resolution A.1050(27).

1.7.2 Means are to be provided to enable the Surveyor to examine the structure in a safe and practical way. Where the provisions of safety and required access are determined by the Surveyor not to be adequate, then the survey of the space(s) involved is not to proceed.

1.7.3 Spaces are to be made safe for access and survey and are to be sufficiently cleaned, illuminated and ventilated.

1.7.4 In preparation for survey, thickness measurements and to allow for a thorough examination, cleaning is to include removal from surfaces of all loose accumulated corrosion scale. Spaces are to be sufficiently clean and free from water, scale, dirt, and oil residues, etc. to reveal corrosion, deformation, fractures, damages or other structural deterioration, as well as the condition of the protective coating. However, those areas of structure whose renewal has already been decided by the Owner need only be cleaned and descaled to the extent necessary to determine the limits of renewed areas.

1.7.5 Where soft or semi-hard coatings have been applied, safe access is to be provided for the Surveyor to verify the effectiveness of the coating and to carry out an assessment of the conditions of internal structures which may include spot removal of the coating. When safe access cannot be provided, the soft or semi-hard coating is to be removed.

1.7.6 Prior to entering an enclosed space, it is to be verified by a competent person, using a calibrated multi gas meter, that the atmosphere in that space is free from hazardous gas and contains sufficient oxygen.

1.7.7 Emergency equipment and personnel are to be available in case of an emergency or rescue operation.

1.7.8 Information on procedures, equipment-operating instructions and safety checklists is to be available.

1.7.9 During the survey, ventilation is to be ensured and periodic testing is to be carried out as necessary to verify that the atmosphere remains safe for access.

1.7.10 Rescue and emergency response equipment: if breathing apparatus and/or other equipment is used as ‘rescue and emergency response equipment’, the equipment is to be suitable for the configuration of the space being surveyed.

■ *Section 2*
Special surveys – Hull requirements

2.1 General

2.1.1 The full requirements of the annual and underwater surveys are to be complied with together with the following:

The spaces between the safety and top working decks are to be cleared and cleaned as necessary and examined; lining and pipe casings are to be removed as required.

2.1.2 The Surveyor may require the gauging of the thickness of the materials of any portion of the structure by means of ultrasonic testing, where signs of wastage are evident or wastage is normally found. Any parts of the structure which are found defective or materially reduced in scantlings are to be made good by materials of the approved scantlings and quality.

2.1.3 Where the inner surface of the bottom plating is covered with cement, asphalt or other composition, the removal of this covering may be dispensed with, provided it be inspected, tested by beating or chipping, and found sound and adhering satisfactorily to the steel.

2.1.4 Pontoon and side wall tanks are to be cleaned and examined internally and tested by a head sufficient to give the maximum pressure that can be experienced in service.

2.1.5 Wood deck sheathing is to be examined, if decay or rot is found, or the wood is excessively worn, it is to be renewed. Attention is to be given to the condition of the plating under the sheathing or other deck covering. If it is found that such coverings are broken or not adhering closely to the plating, sections are to be removed as necessary to ascertain the condition of the plating.

2.1.6 The Surveyor is to satisfy himself as to the efficient condition of the following:

Means of escape from:

(a) Machinery spaces.
(b) Crew spaces.
(c) Spaces in which crew are normally employed.

Means of communication between control position and machinery spaces.

2.1.7 For floating docks not more than 15 years old, fuel oil tanks forming part of the main structure need not be examined internally. When examining tanks internally, the Surveyor is to satisfy himself as to the condition of the pump suctions.

2.1.8 At the first Special Survey held after the floating dock or dock gate is 25 years old and at every 10 years thereafter or at the next Special Survey after the expiration of the latter period, the full requirements of *Pt 1, Ch 3, 2.1 General 2.1.1* to *Pt 1, Ch 3, 2.1 General 2.1.7* together with *Pt 1, Ch 3, 2.1 General 2.1.9* and *Pt 1, Ch 3, 2.1 General 2.1.10* are to be complied with.

2.1.9 In addition to the thickness measurement to ascertain local wastage, the outside plating of the walls and pontoons are to be gauged by ultrasonic testing to determine the amount of any general diminution in thickness. The gauging is to be done in at least two places in each strake of plating on each side within the amidship half-length.

2.1.10 Measured thicknesses are to be reported. Where gauged plates are renewed, the thickness of adjacent plates in the same strake are to be reported.

■ *Section 3* **Machinery surveys – General requirements**

3.1 Periodical surveys

3.1.1 The Periodical Surveys of boilers, machinery, electrical installations and control engineering systems are to be in accordance with the relevant requirements of *Pt 1, Ch 3 Periodical Survey Regulations* of the Rules for Ships, so far as these are applicable.

3.1.2 All sea connections are to be opened up as part of the machinery survey, but where this is not practicable the Committee will be prepared to consider alternative proposals having regard to the circumstances of each case, provided full particulars are submitted.

■ *Section 4* Classification of floating docks and dock gates not built under survey

4.1 General

4.1.1 When classification is desired for a floating dock or dock gate not built under the supervision of Lloyd's Register (hereinafter referred to as 'LR') Surveyors, application should be made to the Committee in writing.

4.1.2 Periodical Surveys of such floating docks or dock gates, when classed, are subsequently to be held as in the case of floating docks built under survey.

4.2 Hull

4.2.1 Plans showing the main scantlings and arrangements of the actual floating dock or dock gate and any proposed alterations are to be submitted for approval. These should comprise, section at mid-length, longitudinal section and decks, and such other plans as may be requested. If plans cannot be obtained or prepared by the Owner, facilities are to be given to LR's Surveyors to take the necessary information from the floating dock.

4.2.2 Particulars of the process of manufacture and the testing of the material of construction are to be supplied.

4.2.3 In all cases the full requirements of *Pt 1, Ch 3, 2.1 General 2.1.1* to *Pt 1, Ch 3, 2.1 General 2.1.8* are to be carried out. Floating docks and dock gates over 25 years old are in addition to comply with the requirements of *Pt 1, Ch 3, 2.1 General 2.1.8* to *Pt 1, Ch 3, 2.1 General 2.1.10*.

4.2.4 During the survey the Surveyors are to satisfy themselves regarding the workmanship and verify the approved scantlings and arrangements. For this purpose, and in order to ascertain the amount of any deterioration, parts of the structure will require to be gauged as necessary. Fire protection, detection and extinction are to be in accordance with these Rules (*see Pt 2, Ch 4 Machinery Installations*). For dock gates, the seal life is to be confirmed and seals replaced if considered necessary, *see also Pt 1, Ch 3, 1.2 Underwater surveys 1.2.3*. Floating docks and dock gates of recent construction will receive special consideration.

4.2.5 When the full survey requirements indicated in *Pt 1, Ch 3, 4.2 Hull 4.2.3* and *Pt 1, Ch 3, 4.2 Hull 4.2.4* cannot be completed at one time, the Committee may consider granting an interim record for a limited period. The conditions regarding the completion of the survey will depend on the merits of each particular case, which should be submitted for consideration.

4.3 Machinery

4.3.1 The requirements as given in the Rules for Ships, for the classification of ships not built under survey, so far as these are applicable to floating docks, are to be complied with, *see Pt 1, Ch 3, 20.3 Machinery* of the Rules for Ships.

Contents

PART 1 REGULATIONS

PART 2 RULES FOR CONSTRUCTION

CHAPTER 1 STRUCTURES – FLOATING DOCKS

CHAPTER 2 STRUCTURES – DOCK GATES

CHAPTER 3 FIRE PROTECTION, DETECTION AND EXTINCTION

CHAPTER 4 MACHINERY INSTALLATIONS

Section
1 **General**

2 **Definitions**

3 **Longitudinal strength**

4 **Transverse strength**

5 **Local strength**

6 **Additional items**

7 **Testing**

8 **Welding**

■ *Section 1* General

1.1 Application

1.1.1 These Rules apply to Caisson and Pontoon type steel floating docks, as defined in *Pt 2, Ch 1, 1.2 General design 1.2.1*. Although the Rules are, in general, for steel floating docks of all welded construction, other materials and design configurations will be specially considered.

1.2 General design

1.2.1 These Rules apply directly to floating docks of the following types:

(a) Caisson type, in which the bottom caisson and both wing walls are continuous and inseparable.

(b) Pontoon type, in which the wing walls are continuous and the bottom is formed of non-continuous pontoons. The pontoons may be either permanently attached to the wing walls or may be detachable.

1.3 Material

1.3.1 The materials used in the construction of the floating dock are to be manufactured and tested in accordance with the requirements of the *Rules for the Manufacture, Testing and Certification of Materials, July 2021*. Materials for which provision is not made therein may be accepted, provided that they comply with an approved specification and such tests as may be considered necessary.

1.3.2 Steel having a specified minimum yield stress of 235 N/mm^2 is regarded as mild steel. Steel having a higher specified minimum yield stress is regarded as higher tensile steel.

1.3.3 The local scantling requirements of higher tensile steel plating, longitudinals, stiffeners and girders may be based on a *k* factor determined as follows:

$$k = \frac{235}{\sigma_o}$$

or 0,66, whichever is the greater,

where

σ_o = specified minimum yield stress in N/mm^2.

1.3.4 For the determination of the required section moduli, in *Pt 2, Ch 1, 3.5 Bending moment 3.5.2* and *Pt 2, Ch 1, 3.5 Bending moment 3.5.3*, where higher tensile steel is used, a longitudinal higher tensile steel factor, k_L, may be used as given in *Table 1.1.1 Longitudinal higher tensile steel factor, k_L*.

Table 1.1.1 Longitudinal higher tensile steel factor, k_L

Specified minimum yield stress in N/mm^2	k_L
235	1,00
265	0,92
315	0,78
355	0,72
Note Intermediate values are to be obtained by linear interpolation.	

1.3.5 For the application of the requirements of *Pt 2, Ch 1, 1.3 Material 1.3.3* and *Pt 2, Ch 1, 1.3 Material 1.3.4*, special consideration will be given to steel where $\sigma_o \geq 355$ N/mm^2.

1.3.6 Where higher tensile steel is used in areas which are subject to fatigue loading, and in particular for floating docks intended to undertake an ocean tow, the structural details may be required to be verified using fatigue design assessment methods.

1.4 Equivalents

1.4.1 The scantlings of structural members may also be determined using direct calculations. In such a case, the assumptions made, together with the calculations are to be submitted for approval. Alternative arrangements which are proposed as equivalent to these Rules, will also be considered.

1.5 Plans required

1.5.1 The following plans are to be submitted for approval:

- General arrangement plan.
- Section at mid-length.
- Structural plan of wing walls, top deck, safety deck and, for pontoon type docks, the plating across the base of the wing walls in way of the pontoon gaps.
- Structural plan of bottom caisson or pontoons.
- Fresh water and fuel oil tanks.
- Hydrostatic curves.

1.6 Data required

1.6.1 In addition to the requirements of *Pt 2, Ch 1, 1.5 Plans required*, the information related to the operating site and method of dock securing, are to be submitted together with the following:

(a) Required lifting capacity.
(b) Length of shortest contemplated ship having a docking weight equal to the required lifting capacity. Special consideration may be given to the use of a ship length greater than that described, *see also Pt 2, Ch 1, 3.7 Special provision 3.7.1*.
(c) The associated maximum draught of the vessel when entering the dock, also the maximum associated dock submergence draught.
(d) Dock lightweight.

The total lightweight should be sub-divided into weights of:

(i) pontoon or caisson;
(ii) wing walls above pontoon/caisson dock level;
(iii) supporting blocks;
(iv) cranes;
(v) machinery and outfit;
(vi) end aprons/working platforms.

(e) Depth of rest water.
(f) Depth of keel and side blocks.

(g) Proposed distance of air pipe openings below the safety deck in side tanks and/or the pontoon/caisson deck in centre tanks, as applicable.
(h) The hydrostatic head assumed for the design of boundary bulkheads separating adjacent ballast tanks, to be taken as the maximum allowable difference between the filling levels of adjacent ballast tanks. This head should be included in the dock operating instructions. If not specified, it will be taken as 3,5 m.
(i) The hydrostatic head obtained from Hydrostatic Curves to be used for structural design of dock boundary bulkheads and internal bulkheads which separate a ballast tank from a dry space.
(j) Section modulus calculation.
(k) Full details of the type and proposed arrangement of deflection monitoring equipment.
(l) Details of the mooring attachments to the dock structure.

1.7 Freeboard

1.7.1 The freeboard to the pontoon deck at the centreline of the dock when supporting a ship having a displacement equal to the lifting capacity is to be not less than 300 mm, *see Pt 2, Ch 1, 2.1 General 2.1.1*. When the pontoon deck at the inner wing walls is lower than at the centreline, the freeboard to the pontoon deck at the inner wing walls is to be not less than 75 mm and the freeboard at the centreline is to be not less than 300 mm.

1.7.2 The freeboard requirements within *Pt 2, Ch 1, 1.7 Freeboard 1.7.1* assume the travelling crane(s) are positioned so as to give level trim. The freeboard at level trim may be required to be increased such that when the travelling crane(s) are moved to the forward end or to the after end of the dock, the pontoon deck is not submerged. The freeboard limits within *Pt 2, Ch 1, 1.7 Freeboard 1.7.1* assume the floating dock is to be operated in sheltered waters. For other areas of operation it is recommended that they are suitably increased.

1.8 Stability

1.8.1 A stability information book is to be prepared by the Builder indicating satisfactory metacentric height (GM) for the following conditions of submergence:

(a) full dock submergence;
(b) the submergence draught to the top of keel block assuming full weight of the docked ship supported on blocks.

1.8.2 Whilst the responsibility for the approval of the stability aspects will rest with the National Administration involved, it is recommended that the combined GM of the dock and the ship in the condition indicated in *see Pt 2, Ch 1, 1.8 Stability 1.8.1.(b)* is not less than 1,0 m.

1.8.3 For operating sites exposed to wind heeling moments, these effects should be taken into account. *See also Pt 1, Ch 2, 1.1 General 1.1.8*.

1.9 Ocean tow

1.9.1 The class of a floating dock will be assigned after it has reached its port of operation and been subjected to a satisfactory General Examination.

1.9.2 Where it is intended that the dock be towed at sea from its port of construction to port of operation or from one port of operation to another, the aspects specified below will need to be investigated, it is recommended that such aspects be considered at as early a stage as possible and Lloyd's Register (hereinafter referred to as 'LR') be consulted on the requirements for issuing of a 'Fitness to be Towed Certificate' (Form 1694):

(a) The longitudinal strength is to be sufficient to accommodate the design voyage wave bending moment in association with the Rule stress as given in *Pt 2, Ch 1, 3.5 Bending moment 3.5.6*. The design voyage wave bending moment will be based on the following information which is to be submitted for consideration:

    (i) draught in towage condition;
    (ii) towage route;
    (iii) departure date.

    In order to minimize the design voyage wave bending moment, it is recommended that the delivery voyage be undertaken as close to the light draught as possible.
(b) Particular attention should be given to the buckling capability of transversely framed bottom structure when the dock is subjected to wave induced hogging moments, since this part of the structure will not normally experience longitudinal compressive loading during floating dock operations.

(c) The removal of aprons/working platforms.
(d) The securing arrangements of travelling crane(s) and items carried on the pontoon deck.

1.10 Rounding policy for plate thickness

1.10.1 Where plating thicknesses as determined by the Rules are required to be rounded, then this should be carried out to the nearest half millimetre, with thicknesses 0,75 mm and 0,25 mm being rounded up.

For example,

- for $10,75 \leq t < 11,25$ mm, the Rule required thickness is 11,0 mm;
- for $11,25 \leq t < 11,75$ mm, the Rule required thickness is 11,5 mm.

■ *Section 2* Definitions

2.1 General

2.1.1 The lifting capacity of the dock, Δ_S, in tonnes, is equal to the displacement of the heaviest ship that the dock is designed to lift in normal service. LR reserves the right, however, to reduce the lifting capacity if the sinkage trials show that insufficient freeboard is available at the pontoon deck when the lifting capacity is added to the light displacement of the dock *see Pt 2, Ch 1, 1.8 Stability*.

2.1.2 The light displacement includes the structural weight of the dock complete with all machinery, crane(s), equipment, fresh water, fuel oil for the use of the dock, compensating ballast water (if required), and rest-water.

2.1.3 The length, L_D, in metres, is the length of the bottom caisson or the distance from the aft end of the aftermost pontoon to the fore end of the forward pontoon, excluding non-integral end platforms or swing bridges.

2.1.4 Amidships is to be taken as the middle of the length L_D.

2.1.5 The breadth, B_D, is the moulded breadth, in metres.

2.1.6 The depth, D_D, in metres, is the vertical distance from the lowest point of the bottom framing to the lower surface of the uppermost deck plating.

2.1.7 The length, L_S, is the length between perpendiculars of the shortest ship whose displacement is equal to the lifting capacity of the dock, in metres. The length L_S, is in general not to be taken as greater than $0,8L_D$. For docks exceeding 40000 tonnes lifting capacity, L_S is not to be taken greater than that obtained from *Table 1.2.1 Ship to dock length ratio per lifting capacity*.

Table 1.2.1 Ship to dock length ratio per lifting capacity

Displacement, Δ_S, in tonnes	Ship to dock length ratio, L_S/L_D
40 000	0,800
45 000	0,826
50 000	0,850
55 000	0,870
60 000	0,888
70 000 and above	0,920
Note Intermediate values may be obtained by linear interpolation.	

2.1.8 The safety deck is a watertight deck arranged at such a distance below the upper deck as to determine the maximum submergence draught of the dock whilst ensuring an air draught to the upper deck of at least 1 m. Alternative arrangements will be specially considered.

2.1.9 The rest-water is the ballast water in the tanks which the pumps cannot discharge.

2.1.10 Compensating ballast water is ballast water which may be used to limit the deflection of the dock by counteracting the ship-induced longitudinal bending moment. Rest-water should not be included in compensating ballast water.

■ *Section 3* Longitudinal strength

3.1 General

3.1.1 The longitudinal strength is to be calculated for the condition when the ship of length L_s is supported on the keel blocks, the centre of the ship's length being over the mid-length of the dock, and the freeboard at the pontoon deck is at least equal to that given in *Pt 2, Ch 1, 1.7 Freeboard 1.7.1*.

3.2 Dock buoyancy

3.2.1 Dock buoyancy distribution may be assumed rectangular over the length of the dock, L_D.

3.3 Ship weight curve

3.3.1 The weight curve of the ship can be taken as a rectangle, of length L_S, with a superimposed parabola of half the area of the rectangle.

3.4 Modulus of section

3.4.1 The material to be included in the calculation of the section modulus will be, for the caisson type dock, all continuous fore and aft material, of the whole dock. For the pontoon type dock, all continuous fore and aft material of the wing walls structure may be included, together with the fore and aft material of the parts of the pontoon structure which are made effectively continuous by longitudinally scarphing the material into the adjacent pontoon for at least 2 m.

3.4.2 In no case should the crane rail be included in the section modulus calculation.

3.5 Bending moment

3.5.1 An approximate value of the sagging bending moment generated during docking of the ship can be obtained by the following expression:

$$M_s = 122,63\Delta_s\left(L_D - 0,917L_s\right) \times 10^{-2}\ \text{kNm}$$

3.5.2 Where it is intended that the normal operation of the dock is performed with ballast water evenly distributed over its entire length, the minimum required modulus in the bottom or upper deck of the floating dock can be obtained by the following formula:

$$Z_{min} = 8,93k_L\Delta_s\left(L_D - 0,917L_S\right)\ \text{cm}^3$$

3.5.3 Where provision is made for the normal operation of the dock to be complemented by the differential emptying of the ballast compartments, the required minimum section modulus can be obtained by the following formula:

$$Z_{min} = 5,682k_L\Delta_s\ \left(L_D - 0,917L_S\right)\ \text{cm}^3$$

However, for this type of operation of the floating dock, an efficient deflection control system is to be installed, *see also Pt 2, Ch 1, 3.6 Deflection control system*. The quantity and distribution pattern of water ballast intended for use during differential ballasting should be included in the Docking Operation Manual.

3.5.4 The maximum stress for the normal operation of the dock is not to exceed 137,34/K_L N/mm^2.

3.5.5 For pontoon type docks the minimum section modulus satisfying *Pt 2, Ch 1, 3.5 Bending moment 3.5.2* or *Pt 2, Ch 1, 3.5 Bending moment 3.5.3* will be required to be calculated in way of gaps between two adjacent pontoons. Mid-dock scantlings of fore and aft material for both pontoon and caisson type docks should be retained over the middle 0,4L_D. In the case of floating docks with relatively long pontoons, consideration will be given to a possible reduction of scantlings in areas well removed from the gaps.

3.5.6 The requirements set forth in *Pt 2, Ch 1, 3.5 Bending moment 3.5.2*, *Pt 2, Ch 1, 3.5 Bending moment 3.5.3* and *Pt 2, Ch 1, 3.5 Bending moment 3.5.4* are applicable to floating docks which are intended to be operated near the construction yard. In all other cases which involve ocean towage of the floating dock to the operational site, the minimum required section modulus is to be such as to ensure that the maximum stress en route does not exceed $170/K_L$ N/mm^2.

3.5.7 Where requested, use of LR's computer programs are available to clients at an early stage of design development for prediction and the evaluation of the anticipated wave bending moment. For this service to be performed the following data should be submitted:

(a) length of dock over pontoon/caisson;
(b) breadth of dock;
(c) draught in towage condition;
(d) towage route;
(e) departure date.

In all cases, the length of the wave will be taken as L_D and the wave height will be assumed equal to the maximum significant height to be expected during the voyage in tow.

3.6 Deflection control system

3.6.1 Two completely independent deflection monitoring systems, preferably of different types are to be fitted.

3.6.2 Consideration will be given to acceptance of only one deflection control system for docks designed to operate without using differential ballasting.

3.6.3 It is recommended that one of the deflection monitoring systems required should be of the hydraulic type.

3.6.4 The deflection monitoring systems should be capable of outputting deflections over the entire length of the dock. The readings of one of the systems installed should be displayed in the control room of the dock.

3.6.5 In all cases, the methods of monitoring and limiting the dock deflections in service are to be submitted. In general, these methods are to include arrangements for visual and audible warning, and procedures for ballast control to prevent maximum allowable deflections being exceeded. The maximum allowable deflection should be related to the permissible still water bending moment.

3.7 Special provision

3.7.1 Where specially requested, the structural design of the dock may be based on a ship length greater than that defined in *Pt 2, Ch 1, 2.1 General 2.1.7*. In such a case, the lifting capacities at the relevant L_S/L_D ratios are to be clearly stated during submission of plans.

■ *Section 4*
Transverse strength

4.1 General

4.1.1 The primary transverse strength members of the dock, throughout its length, are to be capable of withstanding the sum of the following load components:

(a) Self-weight of the dock with supporting blocks.
(b) Maximum ship weight ordinate obtained from the ship weight curve given in *Pt 2, Ch 1, 3.3 Ship weight curve 3.3.1*,

which can be taken as:

$$W_s = \frac{1,167\Delta_s}{L_s} \text{tonnes/m}$$

Where it is assumed that the entire ship weight is supported throughout its length by keel blocks. Where the spacing between keel blocks is deemed significant, the local loads imposed by the ship may be specially considered, *see Pt 2, Ch 1, 5.13 Local strength of the structure in way of keel blocks and supporting structure*.

(c) External hydrostatic pressure due to given draught. The most severe condition normally occurs when the draught is equal to the depth to the top of the keel blocks.

(d) Internal hydrostatic pressure due to the level of evenly distributed ballast associated with the draught as in (c) when lifting at maximum capacity.

(e) Wing wall reactions required to give equilibrium on the section under consideration. These reactions at inner and outer wing walls may be taken as equal.

4.1.2 When lifting at maximum capacity with a ship length less than that of the dock, the sections clear of the ship will experience transverse hogging due to the combination of loads in (a), (c), (d) and (e) . Hence, this loading case should also be examined for the sections concerned. The most severe condition will usually occur when the ballast depth is at a minimum (i.e. rest water only).

4.1.3 The compressive and tensile stresses computed for the loading conditions given in *Pt 2, Ch 1, 4.1 General 4.1.1* and *Pt 2, Ch 1, 4.1 General 4.1.2* should not exceed 170 N/mm^2. The mean shear stress at any section through the web plating of the primary transverse members should not exceed 95 N/mm^2 and the Von Mises combined stress at any point should not exceed 180 N/mm^2.

4.1.4 For the purpose of stress evaluation, the section modulus of the primary transverse strength members is to comprise the continuous transverse material over the effective width of the primary member. The effective width of pontoon deck and pontoon bottom plating is to be taken as per *Pt 2, Ch 1, 5.4 Framing or tank stiffeners 5.4.2*.

4.1.5 Particular care should be given to the maintenance of transverse strength standard in end sections of floating docks with swim ends where the pontoon depth is reduced.

■ *Section 5* Local strength

5.1 General

5.1.1 Plating and supporting stiffeners are to have scantlings adequate to meet longitudinal and transverse strength requirements, as defined in *Pt 2, Ch 1, 3 Longitudinal strength* and *Pt 2, Ch 1, 4 Transverse strength*. However, in no case shall these scantlings be less than as given within this Section.

5.2 Modulus of stiffeners, frames and longitudinals

5.2.1 For longitudinals, side frames and bulkhead stiffeners, the section modulus required by the appropriate formula is generally applicable to that of the section in association with 600 mm, or 40t, whichever is the greater, of attached plating. Where the attached plating is of varying thickness, the mean thickness over the appropriate span is to be used.

5.3 Tank plating

5.3.1 The thickness of boundary plating in ballast tanks, oil tanks, freshwater tanks, and sewage tanks is to be not less than:

$$t = 0,004 s f \sqrt{\frac{\rho h k}{1,025}} + 2,5 \text{ mm}$$

or 7,5 mm whichever is the greater

where

s = stiffener spacing, in mm

f = $1,1 - \frac{s}{2500 l}$ but need not to be taken greater than 1,0

ρ = specific gravity of liquid carried in tank, but is not to be taken less than 1,025

h = maximum head, in metres, obtained from the hydrostatic curves for that location and related to a point one-third of the height of the plate. If the plate is located in that part of the tank containing the air cushion, then the head should be extended to the lower boundary of the air cushion. For internal transverse or longitudinal watertight bulkheads, *see Pt 2, Ch 1, 1.6 Data required 1.6.1.(h)*

where

l = overall length of the stiffener or length between span points, in metres, *see Figure 1.5.1 Span points*.

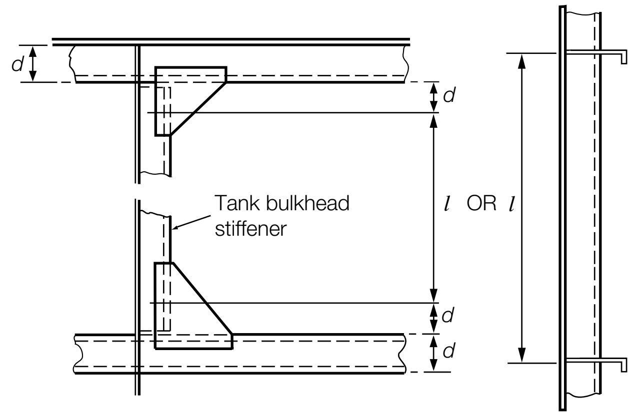


Figure 1.5.1 Span points

5.3.2 Pontoon decks should also be examined for wheel loading, if specified, for compliance with *Pt 3, Ch 9, 3 Decks loaded by wheeled vehicles* of the Rules for Ships.

5.4 Framing or tank stiffeners

5.4.1 The minimum section modulus of stiffeners associated with plating in ballast tanks is to be derived from the following:

$$z = \frac{shkl^2}{157} \text{ cm}^3$$

h = maximum head, in metres, measured from the middle of the span of the stiffeners, and l as in *Pt 2, Ch 1, 5.3 Tank plating 5.3.1*.

5.4.2 The effective section modulus of any transverse, web, stringer or girder is given by:

$$Z = \frac{ad_w}{10} + \frac{t_w d_w^{\,2}}{6000}\left[1 + \frac{200(A-a)}{200\,A + t_w\,d_w}\right] \text{ cm}^3$$

where

a = the area of the face plate of the member, in cm^2

d_w = the depth, in mm, of the web between the inside of the face plate and the attached plating. Where the member is at right angles to a line of corrugations, the minimum depth is to be taken

t_w = the thickness of the web of the section, in mm

A = the area, in cm^2, of the attached plating, *see Pt 2, Ch 1, 5.4 Framing or tank stiffeners 5.4.4*.

If the calculated value of A is less than the face area a, then A is to be taken as equal to a.

5.4.3 The effective area of attached load bearing plating, A, for transverses, webs, stringers or girders, is to be determined as follows:

(a) For a member attached to plane plating:

A = $10K\,b\,t_p$ cm^2, but is not to be taken less than a.

(b) For a member attached to corrugated plating and parallel to the corrugations:

A = $10b\, t_p$ cm^2, but is not to be taken less than a.

(c) For a member attached to corrugated plating and at right angles to the corrugations: A is to be taken as equivalent to the area of the face plate of the member.

where

b = the actual width, in metres, of the load-bearing plating, i.e. for (a) one-half of the sum of spacings between parallel adjacent members or equivalent supports, or for (b) the breath of flat panel of corrugated bulkhead, *see Figure 1.5.2 Corrugation dimensions*

K = load bearing factor to be taken as $0,3\left(\frac{l}{b}\right)^{\frac{2}{3}}$, but is not to exceed 1,0

l = the overall length, in metres, *see Figure 1.5.1 Span points*

t_p = the thickness, in mm, of the attached plating. Where this varies, the mean thickness over the appropriate span is to be used, *see Figure 1.5.2 Corrugation dimensions*.

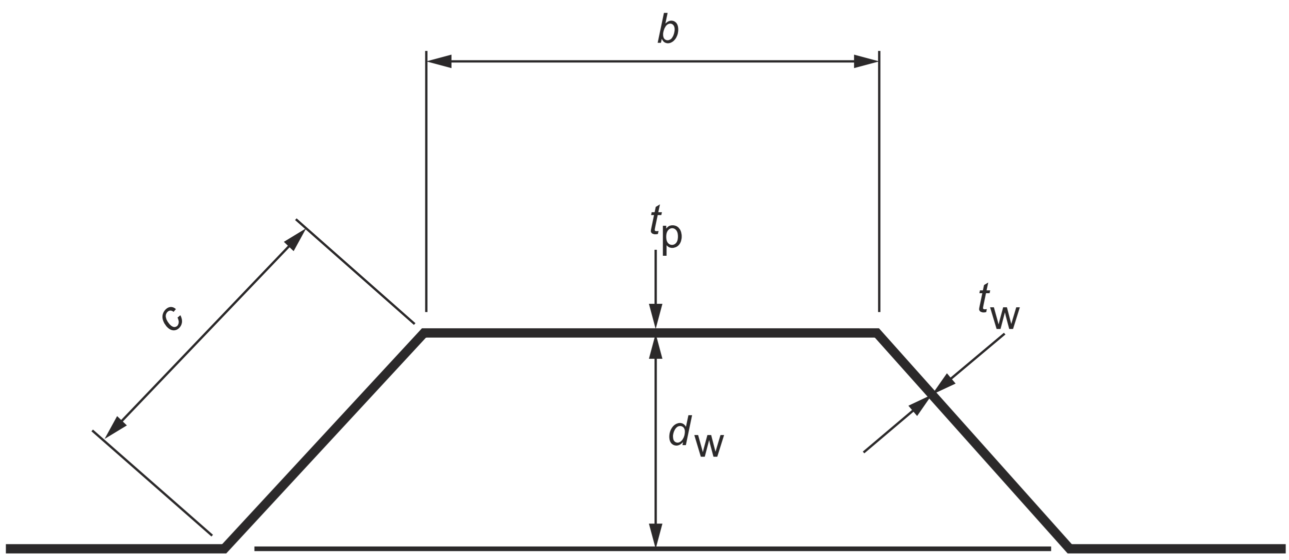


Figure 1.5.2 Corrugation dimensions

5.4.4 For girders, etc. which are symmetrical on each side of the bulkhead, the attached plating is to be ignored and the effective section modulus is given by:

$$Z = \frac{a d_w}{10} + \frac{t_w d_w^{\ 2}}{6000} \text{ cm}^3$$

5.5 Top deck plating

5.5.1 The thickness of plating for the middle 0,4L_D is to be as required for longitudinal strength. For 0,1L_D, at each end of the dock, the thickness is not to be less than 6,5 mm, (with an increase of 3 per cent for every 25 mm that the spacing of longitudinals exceeds 610 mm), unless local conditions or transverse strength considerations require a greater thickness. For the intermediate lengths the thickness of the deck is to be given proportionate values.

5.6 Top deck longitudinals

5.6.1 The top deck should, in principle, be stiffened longitudinally for the middle 0,4L_D. The scantlings will generally be those required to obtain the area necessary for the section modulus derived from longitudinal strength considerations but are to be not less than specified in *Pt 2, Ch 1, 5.6 Top deck longitudinals 5.6.2* for longitudinals at the ends.

5.6.2 For 0,1L_D, at each end of the dock, the scantlings of the longitudinals are to be such that the stress under a loading of 14,37 kN/m^2 does not exceed 131 N/mm^2. The loading may be required to be increased to suit the special requirements of a particular dock. The scantlings of the longitudinals in the intermediate lengths are to be interpolated between those required for the middle and end portions.

5.7 Safety deck plating

5.7.1 The thickness of plating of the safety deck, is to be not less than:

$$t = 0,0033 s f \sqrt{\frac{hk}{C}} + 2,5 \text{ mm}$$

or 7,5 mm whichever is the greater

where

s = stiffener spacing, in mm

f = $1,1 - \frac{s}{2500 l}$ but need not to be taken greater than 1,0

C = stowage rate, in m^3/tonne, but is to be taken as not less than 1,39 m^3/tonne

h = height from top of safety deck beam to top of upper deck beam at side

l = overall length of beam or longitudinal between support points, in metres. *See Figure 1.5.1 Span points*.

5.7.2 Where air pipes project into the wing ballast tanks (*see Pt 2, Ch 1, 6.1 Air pipes under safety deck 6.1.1*), it may be that the pressure in the air cushion exceeds the loading obtained from the above stowage rate and head, in which case the scantlings are to be calculated on the basis of this higher loading.

5.7.3 The section modulus of the beams or longitudinals under the safety deck, including associated plating, is to be in accordance with the following:

$$z = \frac{shkl^2}{161,5C} \text{ cm}^3$$

where l, h, s and C are as defined in *Pt 2, Ch 1, 5.7 Safety deck plating 5.7.1*.

5.7.4 Beams or longitudinals are to be bracketed or continuous as shown in *Figure 1.5.1 Span points*.

5.8 Framing

5.8.1 Framing of wing walls, bottom and pontoon deck is to be in accordance with *Pt 2, Ch 1, 5.4 Framing or tank stiffeners 5.4.1*.

5.9 Transverse and web frames

5.9.1 The loads on the deck transverses are to be in accordance with *Pt 2, Ch 1, 5.4 Framing or tank stiffeners*, *Pt 2, Ch 1, 5.6 Top deck longitudinals* or *Pt 2, Ch 1, 5.7 Safety deck plating*, whichever is applicable. The width of deck supported by the transverse is to be the width between the inner and outer wing walls and the length is to be the spacing of transverses.

5.9.2 The loading on deep side frames and bottom transverses is to be obtained from an analysis of the hydrostatic curves. The permissible stress in transverses and deep frames is to be 131 N/mm^2.

5.10 Cross ties

5.10.1 The sectional area of cross ties, where fitted between the inner and outer wing walls, is to be not less than:

$$A = \frac{hsv}{1,22 - 5,10\frac{l_e}{r}} \text{ cm}^2$$

where

h = the maximum head, in metres, at the cross tie under consideration, and is assumed to occur when the ballast water is level with that tie and the dock is lifting to its maximum capacity. The required value is to be obtained from an analysis of the hydrostatic curves

s = spacing of transverses, in metres

l_e = 0,7 of total span of cross tie, in metres

v = one-half the distance between the centre of the adjacent cross ties and the centre of the bottom or deck transverse, in metres

r = minimum radius of gyration of pillar cross-section, in mm.

As a first approximation, *A* may be taken as:

$$\frac{hsv}{0,92}\ \mathrm{cm}^2$$

and the radius of gyration estimated for a suitable section having this area. If the area calculated using this radius of gyration differs by more than 10 per cent from the first approximation, a further calculation using the radius of gyration corresponding to the mean area of the first and second approximation is to be made.

5.10.2 For the sides of hollow square cross ties or web plates of Channel or *I* sections, the ratio of the breadth to the thickness is not to exceed:

$$600\,\frac{l_{\mathrm{e}}}{r}\ or 55$$

whichever is the greater. The thickness of hollow square cross ties is to be not less than 7,5 mm.

5.10.3 For ordinary angle or channel sections, the ratio of the breadth to the thickness of the flanges is not to exceed:

$$200\,\frac{l_{\mathrm{e}}}{r}\ or 18$$

whichever is the greater.

5.10.4 For fabricated sections or the flanges of *I* section pillars, the ratio of the breadth to the thickness of face plates is not to exceed:

$$400\,\frac{l_{\mathrm{e}}}{r}\ or 36$$

whichever is the greater.

5.10.5 Diagonal cross ties will be specially considered.

5.11 Watertight bulkhead plating and stiffeners

5.11.1 The pontoon centreline girder, where watertight, and the watertight side girders are to be in accordance with *Pt 2, Ch 1, 5.3 Tank plating* and *Pt 2, Ch 1, 5.4 Framing or tank stiffeners*. The strength of these items is to be considered in conjunction with the loading rate given in *Pt 2, Ch 1, 5.13 Local strength of the structure in way of keel blocks and supporting structure 5.13.1* if applicable.

5.12 Non-watertight floors and side girders

5.12.1 The spacing of open floors under pontoon/caisson deck should in principle be not greater than 6,0 m. Where larger spacings are proposed, direct calculations will be necessary to demonstrate their suitability.

5.12.2 Side girders below pontoon deck should be designed to withstand localised loads in way of side blocks where appropriate.

5.12.3 The scantlings of non-watertight bulkheads are to be in accordance with *Table 1.5.1 Non-watertight pillar bulkheads*.

5.13 Local strength of the structure in way of keel blocks and supporting structure

5.13.1 The loading to be taken (over the whole length of the dock) by the keel blocks and supporting structure is to be:

$$W_s = \frac{1,167\Delta_s}{L_s} \text{tonnes/m}$$

where the spacing between keel blocks is significant the loading may be required to be increased.

5.14 Platforms extending from ends of dock

5.14.1 The loading on these structures is generally to be assumed as 5750 N/m^2. If a heavier loading is anticipated or required, the plans are to be marked accordingly.

Table 1.5.1 Non-watertight pillar bulkheads

Parameter	Requirement	
(1) Minimum thickness of plating	7,5 mm in pontoons	
(2) Maximum stiffener spacing	1500 mm	
(3) Minimum depth of stiffeners or corrugations	100 mm	150 mm
(4) Cross-sectional area (including plating) for rolled, built or swedged stiffeners supporting beams, longitudinals, girders or transverses	(a) where $\frac{s}{t} \leq 80$,	$A = A_1$
	(b) where $\frac{s}{t} \geq 120$,	$A = A_2$
	(c) where $80 < \frac{s}{t} < 120$,	A is obtained by interpolation between A_1 and A_2
(5) Cross-sectional area (including plating) for symmetrical corrugation	(a) where $\frac{b}{t_p} \leq \frac{750 \lambda l_e}{(\lambda + 0,25) r}$	$A = A_1$
	(b) where $\frac{b}{t_p} \geq \frac{750 \lambda l_e}{(\lambda + 0,25) r}$	$A = A_2$

Symbols
A = cross-sectional area of stiffener and attached plating, in cm^2
$A_1 = \dfrac{P}{12,36 - 51,5\dfrac{l_e}{r}}$ cm^2
As a first approximation A_1 may be taken as $\dfrac{P}{9,32}$
$A_2 = \dfrac{P}{4,9 - 14,7\dfrac{l_e}{r}}$ cm^2
As first approximation A_2 may be taken as $\dfrac{P}{3,92}$
P = load, in kN, supported by the pillar. The greater of either the load due to the head of water acting on the pontoon deck and bottom plating (obtainable by analysis of hydrostatic curves), or the load due to the weight of the ship on the keel blocks as detailed in *Pt 2, Ch 1, 5.13 Local strength of the structure in way of keel blocks and supporting structure 5.13.1*
l_e = effective length of pillar, in metres, and is taken as 0,8 of the total depth of the non-watertight girder or bulkhead
s = spacing of stiffeners, in mm
r = radius of gyration of stiffener and attached plating, in mm
$= 10\sqrt{\dfrac{I}{A}}$ mm for rolled, built or swedged stiffeners
$= d_w \dfrac{3b + c}{12(b + c)}$ mm for symmetrical corrugation
I = moment of inertia of stiffener and attached plating, in cm^4
$\lambda = \dfrac{b}{c}$
d_w, t_p, b, c are as defined in *Figure 1.5.2 Corrugation dimensions*

5.15 Swing bridges at end of dock

5.15.1 The loading on this connecting bridge is generally to be assumed as 3590 N/m^2. If a heavier loading is anticipated or required, the plan is to be marked accordingly.

■ *Section 6*
Additional items

6.1 Air pipes under safety deck

6.1.1 The maximum draught of the dock may be controlled by fitting air pipes under the safety deck and/or the centre pontoons. The length of these pipes will be dependent on the extent of the cushion of air desired. The pipes are to be of substantial thickness and rigidly supported in place. *See also Pt 5, Ch 12 Piping Design Requirements* of the Rules for Ships.

6.2 Cranes

6.2.1 The structure of travelling cranes on the top deck is not included in LR’s survey unless specially desired. The all-up weight of cranes, and the arrangement of wheels and rails, are to be indicated on the plans, so that local strength requirements

due to these loads may be taken into account. In particular, the buckling strength of the topside supporting hull structure must be shown to be adequate.

6.3 Manholes

6.3.1 Sufficient manholes are to be cut in the safety deck, pontoon deck, transverses and girders in pontoons to provide ventilation and access to all parts of the structure. The edges of the holes are to be smooth. Where covers are fitted to manholes by bolts, doubling rings are to be fitted to take the fastenings. Manhole covers which project above the surrounding plating, which are vulnerable to damage, are to be adequately protected.

6.4 Cofferdams

6.4.1 Compartments carrying oil are to be separated by cofferdams from those carrying fresh or feed water. Cofferdams are to be suitably ventilated.

■ *Section 7* Testing

7.1 General

7.1.1 Each ballast tank, oil tank, fresh water tank and cofferdam is to be tested by a combination of leak tests and structural tests as outlined in *Pt 2, Ch 1, 7.2 Leak tests* and *Pt 2, Ch 1, 7.3 Structural tests*.

7.1.2 For testing of other items, if fitted, *see Pt 3, Ch 1, 9 Procedures for testing tanks and tight boundaries* of the *Rules and Regulations for the Classification of Ships, July 2021*.

7.2 Leak tests

7.2.1 Each ballast tank is to be tested for leaks by means of a soapy solution examination while the tank is subjected to an air pressure of 0,14 kgf/cm^2. It is recommended that the pressure in the tank be raised to 0,21 kgf/cm^2 with the minimum number of personnel in the vicinity of the tank, and then lowered to the test pressure before the examination commences. Precautions are to be taken to prevent excess pressure by the introduction of a relief valve or water gauge. Air testing is normally to be carried out before a protective coating is applied. However, subject to careful inspection by the Surveyors, a complete protective coating may be applied prior to air testing except internally in way of welds made by processes other than automatic. Equivalent proposals for testing will be considered.

7.3 Structural tests

7.3.1 Selected ballast tanks are to be hydraulically tested by filling with water to a depth equal to the maximum operational differential head taken from the hydrostatic curves. Three tanks are to be tested, one port, one starboard, and one middle tank, each at a different point along the length of the dock.

7.3.2 Oil tanks, fresh water tanks and cofferdams are to be separately tested by filling with water to the test head.

7.3.3 When water testing on the building berth is undesirable, testing is to be carried out afloat. The testing afloat is to be so arranged that each tank can successively be examined while being subjected to the head of water. Care is to be taken that the arrangements adopted for testing tanks afloat do not impose undue longitudinal stress on the dock.

7.3.4 Where a preservative coating is to be applied to the internal structure of a tank, the water testing may take place after the application of internal and/or external coatings, provided that the structure is carefully examined to ensure that all welding and structural stiffening are completed prior to the application of the coating. The cause of any discolouration or disturbance of the coating is to be ascertained and any deficiencies repaired.

7.4 Sinkage trials

7.4.1 On the completion of the dock, sinkage trials are to be carried out in the presence of an LR Surveyor. Fresh water tanks and the dock’s fuel tanks are to be full, but ship-oil tanks are to be empty. The travelling cranes may be so positioned that the draughts forward and aft are equal. The density of the water is to be recorded:

(a) **Normal condition.** All ballast water is to be emptied so far as possible, only rest-water remaining. The draughts forward and aft, port and starboard, are to be recorded. The readings on deflection meters are to be taken. The deflection of the dock along the top of keel blocks is to be measured. Adjustment of the meters is then to be made, if necessary, so that they record this built-in permanent deflection in the normal condition. The light displacement is to be evaluated from these readings, and to obtain the light displacement, as defined in *Pt 2, Ch 1, 2.1 General 2.1.2* , the weight of any compensating ballast water is to be added.

(b) **Sagging condition.** Equal amounts of water are to be admitted to corresponding tanks on either side of the middle of the length, the depths increasing until the greatest depth is in the tanks at the middle of the length. The sagging bending moment so produced is to equal that evaluated in *Pt 2, Ch 1, 3.3 Ship weight curve 3.3.1* and *Pt 2, Ch 1, 3.5 Bending moment 3.5.3* respectively. The deflection meter readings are to be recorded and, by allowing for the permanent deflection (*see Pt 2, Ch 1, 7.4 Sinkage trials 7.4.1*), the sagging deflection is obtained.

Alternative arrangements to those described in *Pt 2, Ch 1, 7.4 Sinkage trials 7.4.1.(b)* will be specially considered.

7.4.2 When estimating the quantities of ballast water for *Pt 2, Ch 1, 7.4 Sinkage trials 7.4.1.(b)*, the permissible difference in height of ballast water in adjacent compartments is not to exceed the pressure head for the compartments as laid down in *Pt 2, Ch 1, 5.3 Tank plating 5.3.1*.

■ *Section 8* Welding

8.1 General

8.1.1 The plans to be submitted for approval are to indicate clearly details of the welded connections of main structural members, including the type and size of welds. This requirement includes welded connections to steel castings. The information to be submitted should include the following:

(a) Whether weld sizes given are throat thicknesses or leg lengths.
(b) Grades and thicknesses of materials to be welded.
(c) Location, types of joints and angles of abutting members.
(d) Reference to welding procedures to be used.
(e) Sequence of welding of assemblies and joining up of assemblies, *see Pt 2, Ch 1, 8.4 Welding of primary and secondary member end connections*.

8.1.2 Unless otherwise indicated, all welding is to be in accordance with the requirements of *Ch 13 Requirements for Welded Construction* of the *Rules for the Manufacture, Testing and Certification of Material* (hereinafter referred to as the Rules for Materials).

8.2 Fillet welds

8.2.1 The throat thickness of fillet welds is to be determined from:

$$Throat thickness = t_p \times weld\,factor \times \frac{d}{s}$$

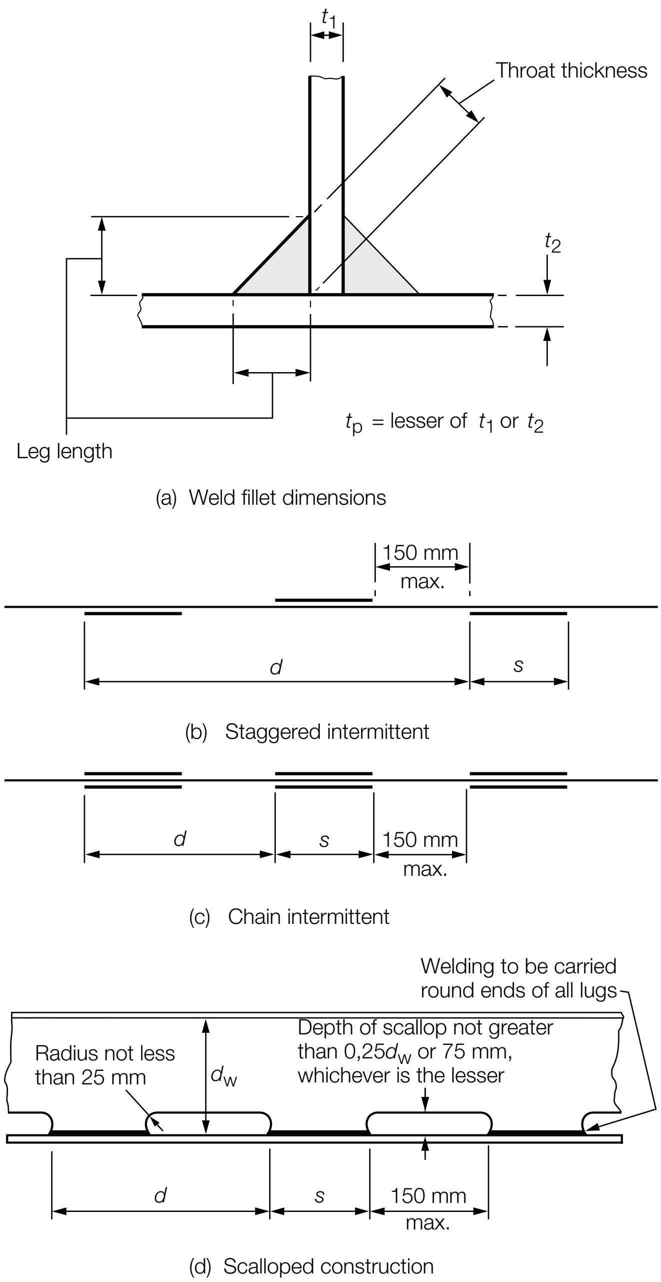
where

s = the length, in mm, of correctly proportioned weld fillet, clear of end craters, and is to be not less than 75 mm

d = the distance between start positions of successive weld fillets, in mm

t_p = plate thickness, on which weld fillet size is based, in mm, *see also Figure 1.8.1 Weld types*

Weld factors are given in *Table 1.8.1 Details of various fillet weld connections*.



NOTE s to be not less than 75 mm, in all cases

Figure 1.8.1 Weld types

8.2.2 Where double continuous fillet welding is proposed, the throat thickness is to be determined taking $\frac{d}{s}$ equal to 1,0. The leg length of the weld is to be not less than $\sqrt{2}$ × the specified throat thickness.

8.2.3 The plate thickness, t_p, to be used in the above calculation is, generally, to be that of the thinner of the two parts being joined. Where the difference in thickness is considerable, the size of fillet will be considered.

8.2.4 Where the thickness of the abutting member of the connection (e.g. the web of a stiffener) is greater than 15 mm and exceeds the thickness of the table member (e.g. plating), the welding is to be double continuous and the throat thickness of the weld is to be not less than the greatest of the following:

(a) 0,21 x thickness of the table member;
(b) 0,21 (0,27 in tanks) × half the thickness of the abutting member;
(c) as required by Item 3 in *Table 1.8.3 Throat thickness limits*.

Table 1.8.1 Details of various fillet weld connections

Item	Weld factor	Remarks
Bottom and side frames and transverse to shell	0,13	continuous in way of beam
Bottom and side longitudinals to shell	0,13	
Bottom and side longitudinals of flat bar or plate type to shell	0,25	
Longitudinal and transverse watertight and oiltight bulkhead boundaries	0,39	at bottom
	0,34	at deck and side
Stiffeners on watertight and oiltight bulkheads	0,13	
Longitudinal and transverse non-watertight bulkhead boundaries	0,13	
Stiffeners on non-watertight bulkheads	0,10	
Pontoon girders to shell	0,27	in way of end brackets
	0,27	clear of end brackets
Pontoon girders to girder brackets	0,21	
Girder webs to face bars	0,13	
Strength deck plating or shell	-	*see Table 1.8.2 Weld connection of strength deck plating to sheerstrake*
Safety deck plating to shell	0,21	continuous
Beams and longitudinals at crown of tanks to deck	0,13	
Beams and longitudinals to deck	0,10	
Deck longitudinals of flat bar or plate type to deck plating	0,25	*see Pt 2, Ch 1, 8.2 Fillet welds*
	continuous	
Deck transverses to plating	0,21	continuous in way of end brackets
Deck transverses to end brackets	0,21	generally continuous
Webs of transverses to face bars	0,13	face bar area in excess of 39 cm^2
Ventilator coamings and air pipes to deck plating	0,34	
Pillars built of rolled sections of plates	0,10	

8.2.5 Except as permitted by *Pt 2, Ch 1, 8.2 Fillet welds 8.2.4*, the throat thickness of the weld is not to be outside the limits specified in *Table 1.8.3 Throat thickness limits*.

8.2.6 Continuous welding is to be adopted in the following locations, and may be used elsewhere if desired:

(a) Boundaries of weathertight decks and erections, including hatch coamings, companionways and other openings.
(b) Boundaries of tanks and watertight compartments.
(c) All lap welds in tanks.
(d) Primary and secondary members to bottom shell.

(e) Primary and secondary members to plating in way of end connections, and end brackets to plating in the case of lap connections.

(f) Where *Pt 2, Ch 1, 8.2 Fillet welds 8.2.4* applies.

(g) Other connections or attachments, where considered necessary, and in particular the attachment of minor fittings to higher tensile steel plating.

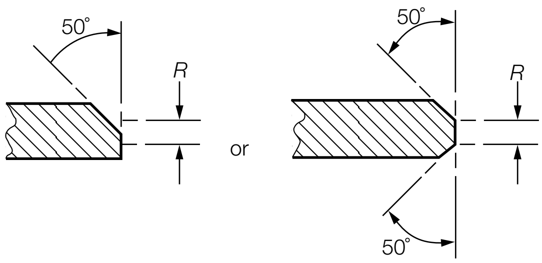
(h) Fillet welds where higher tensile steel is used.

8.2.7 Where structural members pass through the boundary of a tank, and leakage into the adjacent space could be hazardous or undesirable, full penetration welding is to be adopted for the members for at least 150 mm on each side of the boundary. Alternatively, a small scallop of suitable shape may be cut in the member close to the boundary outside the compartment, and carefully welded all round.

Table 1.8.2 Weld connection of strength deck plating to sheerstrake

Item	Stringer plate thickness	Weld type
1	$t \leq 15$	Double continuous fillet weld with a weld factor of 0,44
2	$15 < t \leq 20$	Single vee preparation to provide included angle of 50º with root $R \leq 1/3\ t$ in conjunction with a continuous fillet weld having a weld factor of 0,39 or Double vee preparation to provide included angles of 50º with root $R \leq 1/3\ t$
3	$t > 20$	Double vee preparation to provide included angles of 50º with root $R \leq 1/3\ t$ but not to exceed 10 mm

Where t = thickness of stringer plate, in mm



Single vee preparation Double vee preparation

Note 1. Welding procedure, including joint preparation, is to be specified. Procedure is to be qualified and approved for individual Builders.

Note 2. For thickness t in excess of 30 mm, the stringer plate may be bevelled to achieve a reduced thickness at the weld connection. The width of bevel is, in general, to be not less than twice the thickness of stringer plate and the reduced thickness, in general, to be not less than 0,65 times the thickness of stringer plate or 20 mm, whichever is the greater.

Note 3. Alternative connections will be considered.

8.3 Welding of primary structure

8.3.1 The weld connection to shell, deck or bulkhead is to take account of the material lost in the notch where longitudinals or stiffeners pass through the member.

8.3.2 Where the width of notch exceeds 15 per cent of the stiffener spacing, the weld factor is to be multiplied by:

$$\frac{0{,}85 \times stiffenerspacing}{lengthofwebplatingbetweennotches}$$

8.3.3 Where direct calculation procedures have been adopted, the weld factors for the 0,2 x overall length at the ends of the members will be considered in relation to the calculated loads.

8.3.4 The throat thickness limits given in *Table 1.8.3 Throat thickness limits* are to be complied with.

Table 1.8.3 Throat thickness limits

Item	Throat thickness, in mm	
	Minimum	Maximum
(1) Double continuous welding	$0{,}21t_p$	$0{,}44t_p$
(2) Intermittent welding	$027t_p$	$0{,}44t_p$ or 4,5
(3) All welds, overriding minimum:		
(a) Plate thickness $t_p \leq 7{,}5$ mm		
Hand or automatic welding	3,0	-
Automatic deep penetration welding	3,0	-
(b) Plate thickness $t_p > 7{,}5$ mm		
Hand or automatic welding	3,25	-
Automatic deep penetration welding	3,0	-

Note 1. In all cases, the limiting value is to be taken as the greatest of the applicable values given above.

Note 2. Where t_p exceeds 25 mm, the limiting values may be calculated using a notional thickness equal to 0,5 (t_p + 25) mm.

Note 3. The maximum throat thicknesses shown are intended only as a design limit for the approval of fillet welded joints. Any welding in excess of these limits is to be to the Surveyor's satisfaction.

8.4 Welding of primary and secondary member end connections

8.4.1 Welding of end connections of primary members is to be such that the area of welding is not less than the cross-sectional area of the member, and the weld factor is to be not less than 0,34 in tanks or 0,27 elsewhere.

8.4.2 The welding of secondary member end connections is to be not less than as required by *Table 1.8.4 Primary and secondary member end connection welds*. Where two requirements are given, the greater is to be complied with.

8.4.3 The area of weld, A_w, is to be applied to each arm of the bracket or lapped connection.

8.4.4 Where a longitudinal strength member is cut at a primary support and the continuity of strength is provided by brackets, the area of weld is to be not less than the cross-sectional area of the member.

8.4.5 Where the secondary member passes through, and is supported by, the web of a primary member, the weld connection is to have an area not less than 0,5 $\sqrt{Z}$ and a weld factor of 0,34 in tanks or 0,27 in dry spaces. $\sqrt{Z}$ is defined in *Table 1.8.4 Primary and secondary member end connection welds*.

8.4.6 The throat thickness limits given in *Table 1.8.3 Throat thickness limits* are to be complied with.

Table 1.8.4 Primary and secondary member end connection welds

Connection	Weld area, A_w, in cm^2	Weld factor
(1) Stiffener welded direct to plating	$0{,}25A_s$ or 6,5 cm^2 whichever is the greater	0,34
(2) Bracketless connection of stiffeners or stiffener lapped to bracket or bracket lapped to stiffener:		
(a) in dry space	$1{,}2\sqrt{Z}$	0,27
(b) in tank	$1{,}4\sqrt{Z}$	0,34

(c) main frame to tank side bracket in 0,15L forward	as (a) or (b)	0,34
(3) Bracket welded to face of stiffener and bracket connection to plating	-	0,34
(4) Stiffener to plating for 0,1 x span at ends, or in way of end bracket if that be greater	-	0,34
Symbols		
A_s = cross-sectional area of the stiffener, in cm^2 A_w = the area of weld, in cm^2, and is calculated as total length of weld, in cm, x throat thickness, in cm Z = the section modulus, in cm^3, of the stiffener on which the scantlings of the bracket are based		
Note For maximum and minimum weld fillet sizes, *see Table 1.8.3 Throat thickness limits*.		

8.5 Defined practices and welding sequence

8.5.1 Welding is to be conducted in accordance with the requirements specified in Ch 13,1 and 2 of the Rules for Materials

8.6 Welding consumables and equipment

8.6.1 Welding consumables used and associated equipment are to be in accordance with the requirements specified in Ch 13,1.8 and 2.2 of the Rules for Materials.

8.7 Inspection of welds

8.7.1 Inspection of welds is to be conducted in accordance with the requirements specified in *Ch 13, 1 General welding requirements* and *Ch 13, 2 Specific requirements for ship hull structure and machinery* of the Rules for Materials.

8.7.2 The location and number of welds to be examined by non-destructive examination is to be agreed between the Builder and the Surveyor. Recommended locations and the number of non-destructive examinations are shown in *Table 1.8.5 Inspection of welds*

8.7.3 For docks specially designed to operate in low temperature ambient conditions such as those prevailing in Arctic areas, the extent of non-destructive examination will be specially considered.

8.7.4 For structural details, reference should be made to *Pt 3, Ch 10 Welding and Structural Details* of the Rules for Ships.

Table 1.8.5 Inspection of welds

Material Class *See* Note 1	Recommended locations and number of NDE to be applied	
	Intersections of butts and seams of fabrication and erection welds	Butts and seams *See* Note 2
V & IV	Minimum – One in two	Minimum – One for each 10 m of weld length
III	Minimum – One in three	Minimum – One for each 20 m of weld length
II	Minimum – One in four	Minimum – One for each 30 m of weld length
I	At selected locations *See* Note 3	At selected locations *See* Note 3

	Butt welds of hull envelope longitudinals are to be examined as follows: = Within 0,4*L* amidships – one in ten = Outside 0,4*L* amidships – one in twenty

Note 1. For material class definition, *see Table 2.2.1 Material classes and grades* in Pt 3, Ch 2 of the Rules for Ships.

Note 2. These are in addition to locations selected at intersection of butts and seams of fabrication and erection welds.

Note 3. Additional locations are to be selected in the forward region.

Note 4. Selected NDE locations are to be evenly distributed.

Note 5. Where radiographic examination is carried out at weld intersections, the length of the film is to be in the direction of the butt.

Note 6. Where defects are observed at or near the ends of radiographs, additional radiography is to be carried out to determine the full extent.

Section
1 **General**
2 **Loading**
3 **Structural Design**
4 **Global strength assessment**
5 **Additional assessments**
6 **Local strength**
7 **Towing and lifting arrangements**
8 **Testing**
9 **Construction**
10 **Access arrangements**
11 **Dock gate seals**

■ *Section 1* General

1.1 Application

1.1.1 These Rules apply to dock gates, as defined in *Pt 2, Ch 2, 1.3 Types of dock gate*. Although the Rules are, in general, for steel floating docks of all welded construction, other materials and design configurations will be specially considered.

1.1.2 The following aspects are not covered by these Rules:

(a) connections to the dock walls/entrance;
(b) slots for sliding/rolling dock gates;
(c) stability aspects;
(d) the dock structure supporting the dock gate;
(e) equipment and machinery for operating the dock gate;
(f) electrical and hydraulic systems;
(g) portable equipment, staging or temporary supports; and
(h) mooring lines or dock side winches.

1.2 Basis of design

1.2.1 **Design life**. The design life is to be defined by the designer, however, it is recommended that the design life be at least 60 years.

1.2.2 **Water density**. The water density is to be specified by the designer based on the intended operation of the dock gate. Where the water density is not known, it is to be taken as 1,025 t/m^3.

1.2.3 The global strength assessment is to be carried out on the basis of net scantlings, *see Pt 2, Ch 2, 4.3 Net scantling approach*.

1.2.4 Measures such as coatings and cathodic protection are to be employed in accordance with the requirements of *Pt 3, Ch 2, 3 Corrosion protection* of the *Rules and Regulations for the Classification of Ships, July 2021*.

1.3 Types of dock gate

1.3.1 **Floating dock gate**. A floating dock gate consists of a large floating steel box which is ballasted to seat the dock gate in the opening of the dock. The dock gate is re-floated by de-ballasting and is then towed clear of the entrance to the dry dock. Floating dock gates can also be hinged at the side of the dock. *See Figure 2.1.1 Floating dock gate*.

1.3.2 **Sliding and rolling dock gate**. A floating or sliding dock gate consists of a narrow rectangular box which is opened by moving the gate into a recess in the side of the entrance. The dock gate is lightly ballasted so that it can be moved on a track or slid into the recess. *See Figure 2.1.2 Rolling or sliding dock gate*.

1.3.3 **Mitre gates**. Mitre gates are a pair of hinged gates which form a 'V' shape with the greater hydrostatic pressure being on the outside of the V and hence holding the gates closed. *See Figure 2.1.3 Mitre gate*.

1.3.4 **Flap gates**. Flap gates are hinged at the bottom in way of the entrance sill of a dock and are opened by being lowered down into the water so that they lie flat on the seabed below the entrance sill. Buoyancy tanks are often used in conjunction with hydraulic rams or winches to lower the gate. *See Figure 2.1.4 Flap gate*.

1.3.5 Other types of dock gate such as strutted flap gates, cantilever flap gates, sector gates and lift gates will be specially considered.

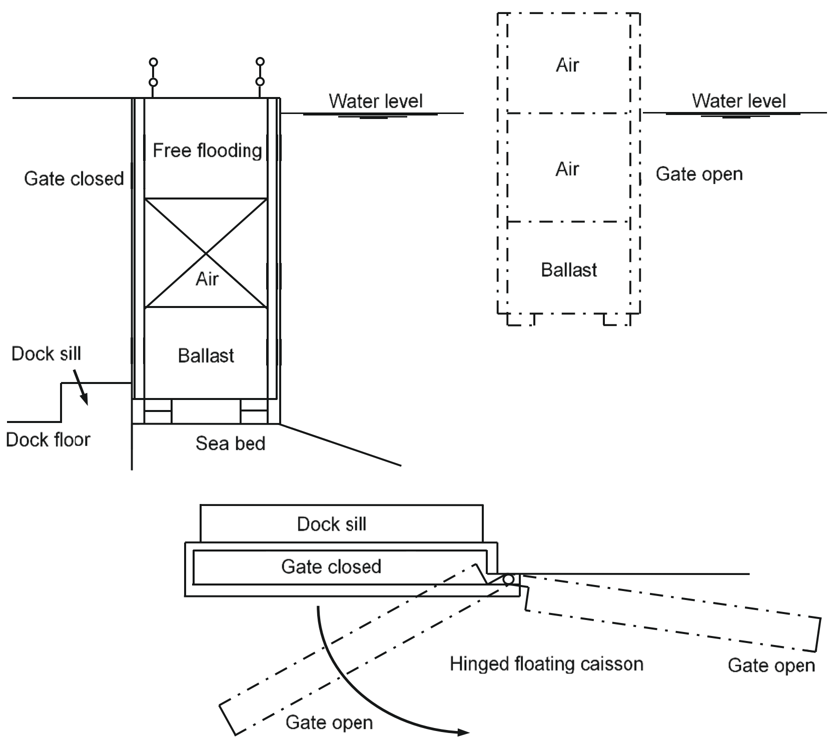


Figure 2.1.1 Floating dock gate

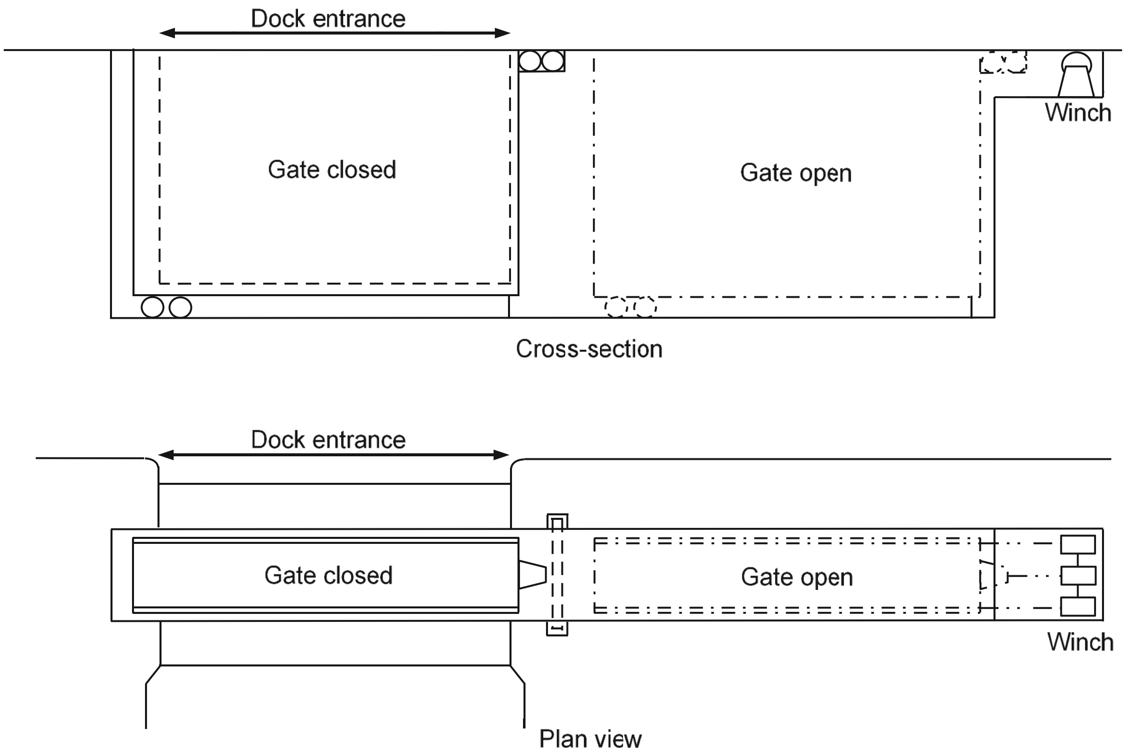


Figure 2.1.2 Rolling or sliding dock gate

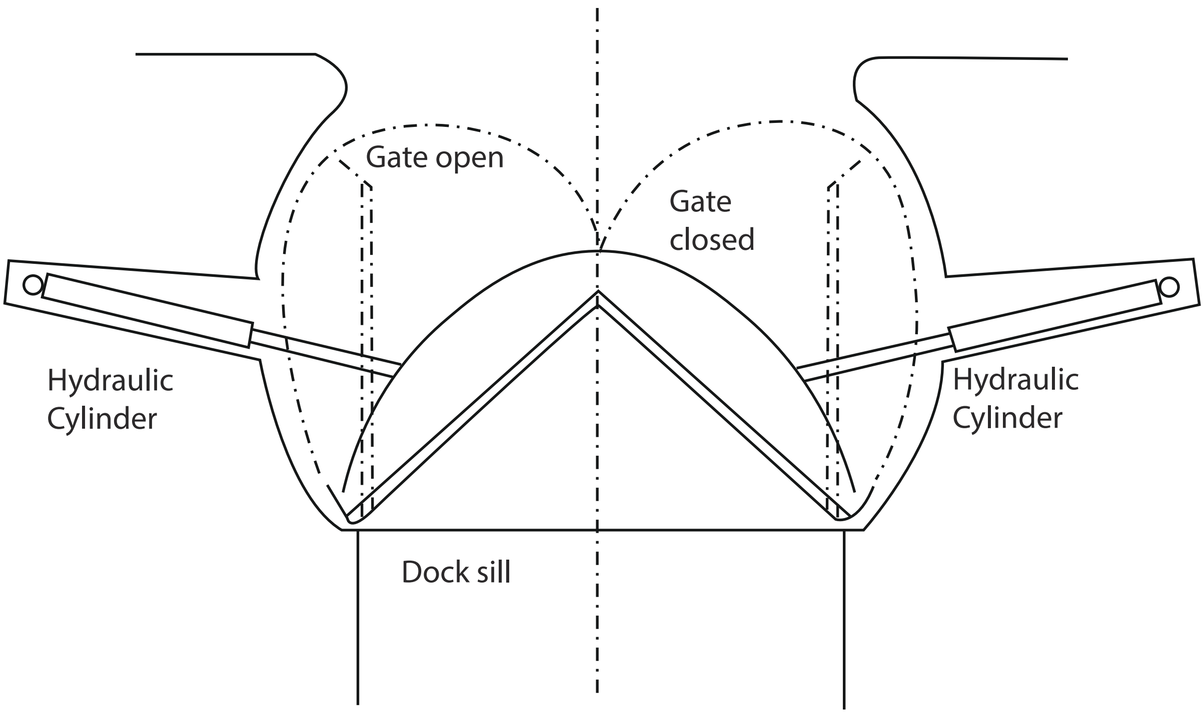


Figure 2.1.3 Mitre gate

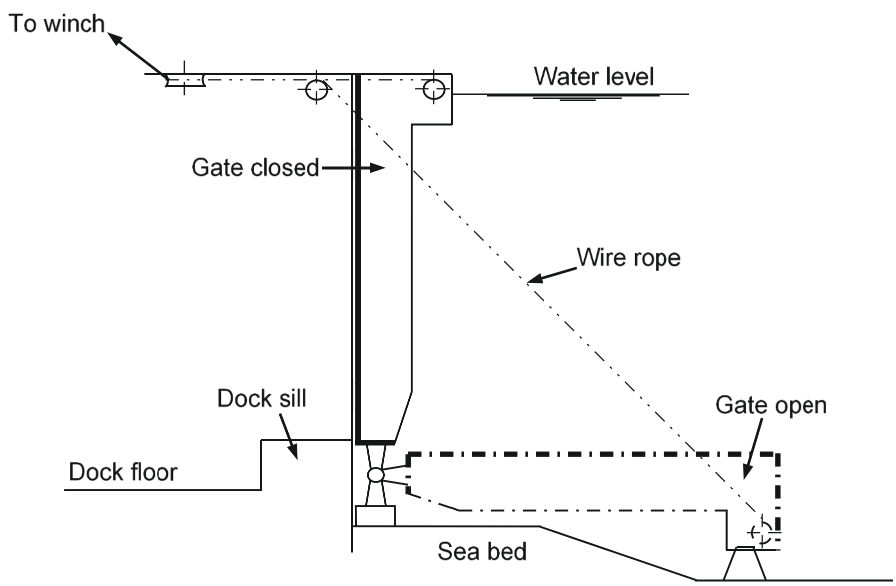


Figure 2.1.4 Flap gate

1.4 Materials

1.4.1 These Rules relate to the construction of welded steel dock gates.

1.4.2 The materials used in the construction of the dock gate are to be manufactured and tested in accordance with the requirements of the *Rules for the Manufacture, Testing and Certification of Materials, July 2021*. Materials for which provision is not made therein may be accepted, provided that they comply with an approved specification and such tests as may be considered necessary.

1.4.3 Steel having a specified minimum yield stress of 235 N/mm^2 is regarded as mild steel. Steel having a higher specified minimum yield stress is regarded as higher tensile steel.

1.4.4 For the determination of the hull girder section modulus, where higher tensile steel is used, a higher tensile steel factor, k_L, is given in *Pt 2, Ch 2, 1.4 Materials 1.4.4*.

Table 2.1.1 Values of k_L

Specified minimum yield stress in N/mm^2	k_L
235	1,0
265	0,92
315	0,78
355	0,72
390	0,68
Note Intermediate values by linear interpolation	

1.4.5 The local scantling requirements of higher tensile steel plating, longitudinals, stiffeners and girders can be based on a *k* factor determined as follows:

$$k = \frac{235}{\sigma_o}$$

or 0,66, whichever is the greater.

where

σ_o = specified minimum yield stress in N/mm^2.

1.4.6 The material grade requirements for hull structural members are to be as required by *Pt 3, Ch 2, 2 Fracture control* of the *Rules and Regulations for the Classification of Ships, July 2021*, but in no case are to be taken less than Grade D.

1.4.7 Consideration will be given to the use of bolted connections within the dock gate main structure. Such bolted connections are to comply with the requirements of Eurocode 3, Part 1-8. All bolts used for primary connections are to be high strength friction grip bolts. For normal operating load scenarios, the bolts are to be designed to be non-slip. Under extreme loading conditions (including seismic), the bolts can be designed on the basis of their ultimate shear strength.

1.5 Plans and information required

1.5.1 A document describing the full operational cycle of the dock gate including repair and maintenance is to be submitted.

1.5.2 The full range of environmental operating conditions is to be defined, including:

- Highest and lowest astronomical tides (HAT and LAT) for the site location and the associated return period.
- Maximum and operational significant wave heights and periods and directions associated with a 60-year return period for the site. Information is also to include the effects of waves from passing marine craft.
- Maximum current speeds and directions at site including the effects of ships' propulsion units.
- Seabed conditions and likelihood of silting in vicinity of site.
- The anticipated effects of passing marine craft at site.
- For areas subject to sub-zero temperatures the lowest mean daily average temperature (MDAT) for the location is to be submitted.
- Extreme snow and ice loading.
- Foreseeable accident events are to be defined including collision, grounding, and degradation
- Seismic conditions where appropriate.

1.5.3 Operational data is to be provided including;

- Vehicle loading data on ramps and decks.
- Design uniformly distributed loadings.
- Loads imposed by tugs or berthing.
- Passenger/pedestrian loadings.
- Docking arrangements.
- Ballasting and de-ballasting sequence where appropriate.
- Design air pressures where compressed air is used for ballasting or de-ballasting operations.
- Any other loadings not specified above.

1.5.4 The following plans are to be submitted for approval:

- General arrangement plan.
- Section at mid-length.
- Structural plans of tank boundaries (if any).
- Structural plan of shell including bottom of dock gate or pontoons (if applicable).
- Structural plans of bulkheads and pillars.
- Structural plans of deck/walkway/roadway.
- Structural plans of ramps.
- Welding and construction details.
- Material grades.
- Mooring and towing attachments and seats.
- Sealing arrangement.
- Air pipes and discharges.
- Corrosion prevention arrangements.
- Hydrostatic curves.

1.5.5 The critical joints and critical weld connections are to be shown on the structural plans.

1.6 Data required

1.6.1 In addition to the requirements of *Pt 2, Ch 2, 1.5 Plans and information required*, the following is to be submitted:

(a) Dock gate lightweight.
(b) The total lightweight should be sub-divided into weights of:
   (i) pontoon or dock gate or walls;
   (ii) wing walls above pontoon/dock gate dock level;
   (iii) supporting blocks;
   (iv) machinery and outfit;
   (v) end aprons/working platforms; and
   (vi) deck roadway surfacing where appropriate.
(c) Depth of water in dock.
(d) Proposed distance of air pipe openings below the safety deck inside tanks and/or the pontoon deck in centre tanks, as applicable.
(e) The hydrostatic head assumed for the design of boundary bulkheads separating adjacent ballast tanks, to be taken as the maximum allowable difference between the filling levels of adjacent ballast tanks. This head should be included in the dock operating instructions. If not specified, it will be taken as 3,5 m.
(f) The hydrostatic head obtained from Hydrostatic Curves to be used for structural design of dock boundary bulkheads and internal bulkheads which separate a ballast tank from a dry space.
(g) Section modulus calculation.
(h) Global strength calculations.
(i) NDE plan showing the critical joints and critical welds.

■ *Section 2* Loading

2.1 General

2.1.1 This Chapter details the loads which are to be considered in the strength assessment of the dock gate, *see*:

- *Pt 2, Ch 2, 4 Global strength assessment*;
- *Pt 2, Ch 2, 5.1 Seismic assessment*;
- *Pt 2, Ch 2, 5.2 Fatigue assessment*;
- *Pt 2, Ch 2, 5.3 Impact assessment*;
- *Pt 2, Ch 2, 5.4 Temperature assessment*; and
- *Pt 2, Ch 2, 6 Local strength*.

2.1.2 Where required by the designer/Operator, additional loads will be specially considered.

2.2 Lightweight

2.2.1 Details of the calculated lightweight and its distribution are to be submitted.

2.3 Hydrostatic loads

2.3.1 Hydrostatic loads are to be based on the following:

(a) maximum operating water level, i.e. highest astronomical tide;
(b) maximum credible water level, i.e. top of structure;
(c) minimum operating water level, i.e. lowest astronomical tide; and
(d) maximum and minimum water level differences at which the gate can be opened and closed.

2.3.2 The maximum water level cases are to consider the most extreme differential of height possible between each side of the gate.

2.3.3 The maximum reverse head of water is also to be considered, i.e. maximum operating water level on the reverse side with the corresponding minimum water level on the opposite side.

2.3.4 Care is to be taken when selecting the maximum hydrostatic loads that the full operational envelope of the dock gate has been considered.

2.3.5 When considering a seismic event, *see Pt 2, Ch 2, 2.6 Seismic loads*, the maximum credible water level is to be taken as the most likely level to be acting in conjunction with the seismic event.

2.3.6 Wave loads are typically insignificant in comparison to maximum hydrostatic loads, however, it may be necessary to consider wave loading in some instances as part of the fatigue assessment, *see Pt 2, Ch 2, 5.2 Fatigue assessment*.

2.4 Deck loading

2.4.1 The design loading acting on the top deck and internal decks of the dock gate is to be taken as a 5 kN/m^2 distributed load.

2.4.2 Where the top deck is used as a roadway, the details of the deck loading resulting from the operation of vehicles are to be supplied by the designer. These details are to include the wheel load, axle and wheel spacing, tyre print dimensions and type of tyre for the vehicles. As a minimum, the distributed load is to be taken as 10 kN/m^2 and the concentrated load as 40kN acting on a 300 mm by 300 mm patch.

2.5 Wind loads

2.5.1 The wind force is to be calculated in accordance with the requirements of *Pt 2, Ch 2, 2.5 Wind loads 2.5.2* to *Pt 2, Ch 2, 2.5 Wind loads 2.5.3*. The wind force acting in the most onerous direction for the case being considered is to be applied.

2.5.2 The wind pressure, p, acting on the structure is given by:

$$p = \frac{V_s^2}{1630} \quad \text{kN/m}^2$$

where

V_s = wind speed, in m/s. To be calculated based on the return period corresponding to 60 years, *see Pt 2, Ch 2, 1.2 Basis of design*.

Table 2.2.1 Force coefficient C_f

Type	Description		Aerodynamic slenderness l/b or l/D					
			5	10	20	30	40	50
Individual members	Rolled sections, rectangles, hollow sections, flat plates, box sections with b or d less than 0,5 m		1,30	1,35	1,60	1,65	1,70	1,80
	Circular sections, where	$DV_s < 6$ m²/s	0,75	0,80	0,90	0,95	1,00	1,10
		$DV_s \geq 6$ m²/s	0,60	0,65	0,70	0,70	0,75	0,80
	Box sections with b or d greater than 0,5 m	b/d						
		≥2,00	1,55	1,75	1,95	2,10	2,20	
		1,00	1,40	1,55	1,75	1,85	1,90	
		0,50	1,00	1,20	1,30	1,35	1,40	
		0,25	0,80	0,90	0,90	1,00	1,00	
Single lattice frames	Flat sided sections		1,70					
	Circular sections, where	$DV_s < 6$ m²/s	1,20					
		$DV_s \geq 6$ m²/s	0,80					

Plated structure	Plated structures on solid base (air flow beneath structure prevented)	1,10
Symbols		
l = length of member, in metres D = diameter of circular section, in metres V_s = wind speed, in m/s b = breadth of box section, in metres d = depth of box section, in metres		

2.5.3 The wind force, F_w, acting on the structure is given by:

$$F_w = ApC_f \quad \text{kN}$$

where

A = is the effective area of the structure concerned, i.e. the solid area projected on to a plane perpendicular to the wind direction, in m^2

p = is the wind pressure as defined in *Pt 2, Ch 2, 2.5 Wind loads 2.5.2*

C_f = is the force coefficient in the direction of the wind, as defined in *Table 2.2.1 Force coefficient C_f*

2.5.4 Wind suction acting on the back of the dock gate is also to be considered.

2.5.5 Wind loading is to be considered in association with the maximum credible water level.

2.6 Seismic loads

2.6.1 Where a seismic assessment is carried out, the dock gate is to be capable of withstanding seismic actions acting in all three orthogonal axes, including vertical accelerations induced within the water column. Seismic inertial forces will result from the combination of the lightweight of the dock gate and any trapped water, with the motion resulting from the seismic action. Added hydrodynamic mass effects should also be considered. The seismic motions are to be calculated in accordance with a recognised National or International Standard.

2.7 Ice loads

2.7.1 Where required, increased mass due to icing is to be considered. If the ice accretion values are not known, then 30 kg/m^2 can be assumed for the horizontal deck and 7,5 kg/m^2 can be assumed for the vertical sides. The ice loads are to be added to the lightweight for the purpose of the strength assessment.

2.8 Internal loads

2.8.1 The design head acting on tank bulkheads is to be taken as the distance from one third above the bottom of the strake of plating to half the height of the overflow above the tank top.

2.9 Air pressure test load

2.9.1 Where compressed air is used to expel water, the maximum test pressure is to be applied to the affected structure.

2.10 Impact

2.10.1 Where an impact assessment is carried out, the loads are to be taken as follows;

- The impact loading resulting from dock gate manoeuvring can be taken as 100 kJ if not otherwise specified.
- The impact loading resulting from a major ship collision (if required) can be taken as 10 MJ if not otherwise specified. The shape of the impacting body is to be agreed with the dock yard operators.

Section 3
Structural Design

3.1 General

3.1.1 Mitre gates and flap gates are to be considered as single plates with vertical girders and horizontal stringers attached. Other configurations will be specially considered.

3.1.2 For floating dock gates where the principal dimensions *B* and *D* are such that the breadth *B* is the same as the span of the deck beams (i.e. no intermediate support is provided) and the depth *D* is less than 6 metres, then the side shell and transverse bulkheads can be considered as a double plate bulkhead.

3.1.3 Sufficient support is to be provided such as ensures 100 per cent end fixity for all members.

3.2 Welding and structural details

3.2.1 Welding and structural details are to be in accordance with the appropriate requirements of *Pt 3, Ch 10 Welding and Structural Details* of the *Rules and Regulations for the Classification of Ships, July 2021*.

3.3 Structural idealisation

3.3.1 For derivation of scantlings of stiffeners, beams, girders, etc. the formulae in the Rules are normally based on elastic or plastic theory using simple beam models supported at one or more points associated with an appropriate concentrated or distributed load.

3.3.2 Apart from local requirements for web thickness or flange thicknesses, the stiffener, beam or girder strength is defined by a section modulus and moment of inertia requirement.

3.3.3 The effective geometric properties of rolled or built sections can be calculated directly from the dimensions of the section and associated effective area of attached plating. Where the web of the section is not normal to the attached plating, and the angle exceeds 20°, the properties of the section are to be determined about an axis parallel to the attached plating.

3.3.4 The geometric properties of rolled or built stiffener sections are to be calculated in association with effective area of attached load bearing plating of thickness t_p mm and of width 600 mm or 40 t_p mm, whichever is the greater. In no case, however, is the width of plating to be taken as greater than the spacing of the stiffeners. The thickness, t_p, is the actual thickness of the attached plating. Where this varies, the mean thickness over the appropriate span is to be used.

3.3.5 The effective section modulus of a built section can be taken as:

$$Z = \frac{a d_w}{10} + \frac{t_w d_w^{\,2}}{6000}\left(1 + \frac{200(A - a)}{200A + t_w d_w}\right)$$

where

a = the area of the face plate of the member, in cm^2

d_w = the depth, in mm, of the web between the inside of the face plate and the attached plating.

t_w = the thickness of the web of the section, in mm

A = the area, in cm^2, of the attached plating, *see Pt 2, Ch 2, 3.3 Structural idealisation 3.3.6*. If the calculated value of A is less than the face area a, then A is to be taken as equal to a.

3.3.6 The geometric properties of primary support members (i.e. girders, transverses, webs, stringers, etc.) are to be calculated in association with an effective area of attached load bearing plating, A, determined as follows:

$$A = 10 f b t_p$$

where

f = $0{,}3\left(\frac{l}{b}\right)^{2/3}$, but is not to exceed 1,0. Values of this factor are given in *Table 2.3.1 Load bearing plating factor*

where

b = the actual width, in metres, of the load-bearing plating, i.e. one-half of the sum of spacings between parallel adjacent members or equivalent supports

l = the overall length, in metres, of the primary support member, *see Figure 2.3.2 Span points*

t_p = the thickness, in mm, of the attached plating. Where this varies, the mean thickness over the appropriate span is to be used.

3.3.7 The effective length, l_e, of a stiffening member is generally less than the overall length, l, by an amount which depends on the design of the end connections. The span points, between which the value of l_e is measured, are to be determined as follows:

(a) For rolled or built secondary stiffening members:

The span point is to be taken at the point where the depth of the end bracket, measured from the face of the secondary stiffening member, is equal to the depth of the member. Where there is no end bracket, the span point is to be measured between primary member webs. For double skin construction, the span may be reduced by the depth of the primary member web stiffener, *see Figure 2.3.2 Span points.*

(b) For primary support members:

The span point is to be taken at a point distant from the end of the member, where

$$b_e = b_b\left(1 - \frac{d_w}{d_b}\right)$$

See also Figure 2.3.2 Span points.

3.3.8 Where the stiffener member is inclined to a vertical or horizontal axis and the inclination exceeds 10°, the span is to be measured along the member.

3.3.9 Where it is assumed that the side shell and transverse bulkheads of a floating dock gate are acting as a double plate bulkhead, the effective section modulus of the combined section is to be calculated as follows:

$$Z = \frac{d_w}{6000}\left(6fbt_p + d_w d_t\right) \text{ cm}^3$$

where

d_w = the breadth of the dock gate, B, in metres

d_t = the bulkhead plate thickness, in mm

t_p = the side shell plate thickness, in mm

b = one-half of the sum of the spacings between adjacent transverse bulkheads (including the ends of the floating dock gate)

f is defined in *Pt 2, Ch 2, 3.3 Structural idealisation 3.3.6* where l is taken as the depth D of the floating dock gate

See also Figure 2.3.1 Double plate bulkhead dimensions.

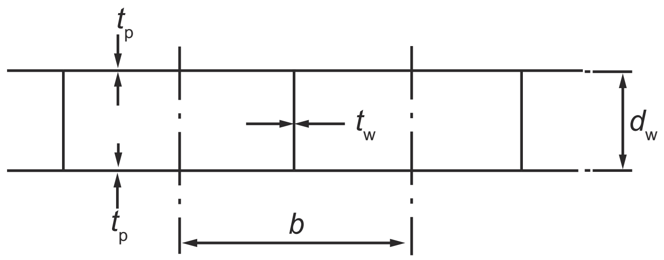


Figure 2.3.1 Double plate bulkhead dimensions

Table 2.3.1 Load bearing plating factor

$\frac{l}{b}$	f	$\frac{l}{b}$	f
0,5	0,19	3,5	0,69
1,0	0,30	4,0	0,76
1,5	0,39	4,5	0,82
2,0	0,48	5,0	0,88
2,5	0,55	5,5	0,94
3,0	0,62	6,0 and above	1,00
Note Intermediate values are to be obtained by linear interpolation			

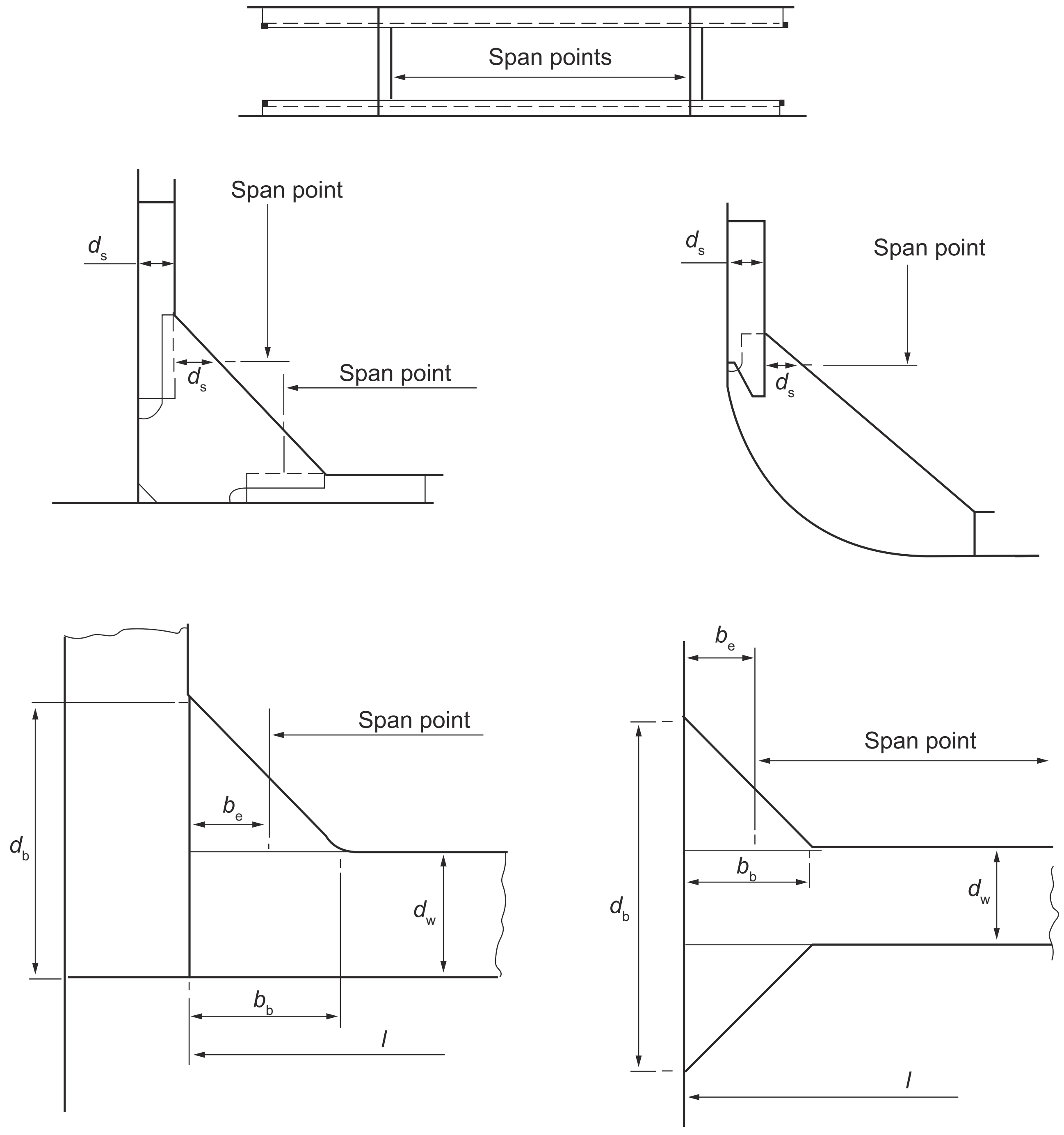


Figure 2.3.2 Span points

Section 4
Global strength assessment

4.1 General

4.1.1 The verification of the stress level, buckling capability and deflection of the dock gate's primary members is to be assessed by direct calculation.

4.1.2 In general, the direct calculation is to be based on a three-dimensional (3-D) FEA carried out in accordance with the procedures contained in this Section. Where alternative procedures are proposed, these are to be agreed with LR before commencement.

4.1.3 If the computer programs employed are not recognised by LR, full particulars of the programs will also be required to be submitted, *see Pt 3, Ch 1, 3.1 Alternative arrangements and scantlings* of the *Rules and Regulations for the Classification of Ships, July 2021*.

4.1.4 A detailed report of the calculations is to be submitted and is to include the following information. The report must show compliance with the specified structural design criteria given in *Pt 2, Ch 2, 4.8 Structural design criteria*.

- list of plans used, including dates and versions;
- detailed description of structural model, including all modelling assumptions;
- plots to demonstrate correct structural modelling and assigned properties;
- details of material properties used for all components;
- details of boundary conditions including seal stiffness properties;
- details of applied loading and confirmation that individual and total applied loads are correct;
- details of boundary support forces and moments;
- plots and results that demonstrate the correct behaviour of the structural model to the applied loads;
- summaries and plots of global and local deflections;
- summaries and sufficient plots of von Mises, directional and shear stresses to demonstrate that the design criteria are not exceeded in any manner;
- plate buckling analysis and results;
- tabulated results showing compliance, or otherwise, with the design criteria; and
- proposed amendments to structure, where necessary, including revised assessment of stresses and buckling properties.

4.1.5 Where required, a seismic assessment is to be carried out in accordance with *Pt 2, Ch 2, 5.1 Seismic assessment*.

4.1.6 A fatigue assessment is to be carried out in accordance with *Pt 2, Ch 2, 5.2 Fatigue assessment*.

4.1.7 Where required, an impact assessment is to be carried out in accordance with *Pt 2, Ch 2, 5.3 Impact assessment*.

4.1.8 Where required, a temperature assessment is to be carried out in accordance with *Pt 2, Ch 2, 5.4 Temperature assessment*.

4.2 Type of analysis

4.2.1 Linear elastic methods capable of accounting for the following are to be used:

(a) global shear lag effects;
(b) asymmetry between the supports and the dock gate centreline;
(c) global deformation of the dock gate; and
(d) rotation/deformation at the boundaries.

4.2.2 Non-linear methods need not normally be employed; however, if they are used then the following aspects are to be considered:

(a) Loss of stiffness/strength in the event of severe buckling; and
(b) Loss of contact at the boundaries.

Non-linear methods are to be agreed with LR prior to the commencement of any investigations.

4.3 Net scantling approach

4.3.1 The global FEM strength assessment is to be carried out based on net scantlings, i.e. an appropriate corrosion addition, t_c, *see Pt 2, Ch 2, 4.4 Corrosion additions*, is to be deducted from the gross offered thickness.

4.3.2 The gross offered thickness, t, is the gross thickness provided at the newbuilding stage, which is obtained by deducting any thickness for voluntary addition from the as-built thickness, i.e. any additional thickness specified by the Owner or builder is not to be included when considering compliance with the Rules.

4.3.3 The strength assessment methods prescribed are to be assessed by applying the corrosion reduction given in *Table 2.4.1 Assessment for corrosion* to the offered gross scantlings where half of the applied corrosion addition is to be deducted from both sides of the structural members being considered.

Table 2.4.1 Assessment for corrosion

Structural requirement	Property/analysis type	Applied corrosion addition
Strength assessment by FEM	Tanks	0,5 t_c
	Buckling capacity	t_c
	Fine mesh	0,5 t_c

4.3.4 The net sectional properties of stiffeners are obtained by deducting half the applied corrosion addition from each surface of the profile cross-section.

4.4 Corrosion additions

4.4.1 The corrosion addition for each of the two sides of a structural member, t_{c1} or t_{c2}, is specified by *Table 2.4.2 Corrosion addition for one side of a structural member*.

4.4.2 A reserve thickness, t_{res}, of 0,5 mm is also to be included.

4.4.3 The total corrosion addition, in mm, for both sides of the structural member is obtained by the following formula:

$$t_c = t_{c1} + t_{c2} + t_{res}$$

4.4.4 For an internal member within a given compartment, the total corrosion addition, in mm, is obtained from the following formula:

$$t_c = 2t_{c1} + t_{res}$$

Table 2.4.2 Corrosion addition for one side of a structural member

Compartment type	Structural member	t_{c1} or t_{c2}
Ballast water and flood water	All members	1,0
Exposed vehicle deck	Deck plating	3,5
Exposed to atmosphere	All members	1,0
Exposed to sea water	All members	1,0
Void spaces	Spaces not normally accessed, e.g. access only via bolted manhole openings, pipe tunnels, inner surface of stool space	0,5
Dry spaces	Internals of machinery spaces, pump room, etc.	0,5
Other tanks and spaces	All members	0,5

4.5 Modelling

4.5.1 A 3-D FE model of the complete dock gate is to be used to assess the primary structure.

4.5.2 The proposed scantlings, excluding any Owner’s extras, are to be used throughout the model. The selected size and type of elements are to provide a satisfactory representation of the deflection and stress distributions within the model.

4.5.3 In general, the plate element mesh is to follow the primary stiffening arrangement. The minimum mesh size requirements are:

- transversely, one element between every longitudinal stiffener;
- longitudinally, three or more elements between web frames;
- vertically, one element between every stiffener; and
- three or more elements over the depth of floors, side transverses, vertical webs and horizontal stringers of bulkheads.

The mesh density of the side shell plating in way of the side frames is to be similar to those adjacent to the side shell plating.

4.5.4 Secondary stiffening members are to be modelled using line elements positioned in the plane of the plating having axial and bending properties (bars). The bar elements are to have:

- a cross-sectional area representing the stiffener area, excluding the area of attached plating; and
- bending properties representing the combined plating and stiffener inertia.

4.5.5 Face plates and plate panel stiffeners of primary members are to be presented by line elements (rods or bars) with the cross-sectional area modified, where appropriate, in accordance with *Table 2.4.3 Line element effective cross-section area* area and *Figure 2.4.1 Effective area of face bars*.

4.5.6 In general, the use of triangular plate elements is to be kept to a minimum. Where possible, they are to be avoided in areas where there are likely to be high stresses or a high stress gradient. These include areas:

- in way of lightening/access holes; and
- adjacent to brackets, knuckles or structural discontinuities.

4.5.7 Access openings, lightening holes, etc. in primary structures are to be represented in areas of interest, e.g. where they are of sufficient size to influence member stiffness. Additional mesh refinement could be necessary to model these openings, but it could be sufficient to represent the effects of the opening by deleting the appropriate elements.

4.5.8 The lightweight of the dock gate is to be represented in the model.

4.5.9 Solid ballast shall be included in the model in its correct position and can be modelled as lumped masses attached to appropriate model nodes provided that the load is appropriately distributed to local nodes. Ballast which is moveable such as pig iron is to be assumed to be located in its most unfavourable position.

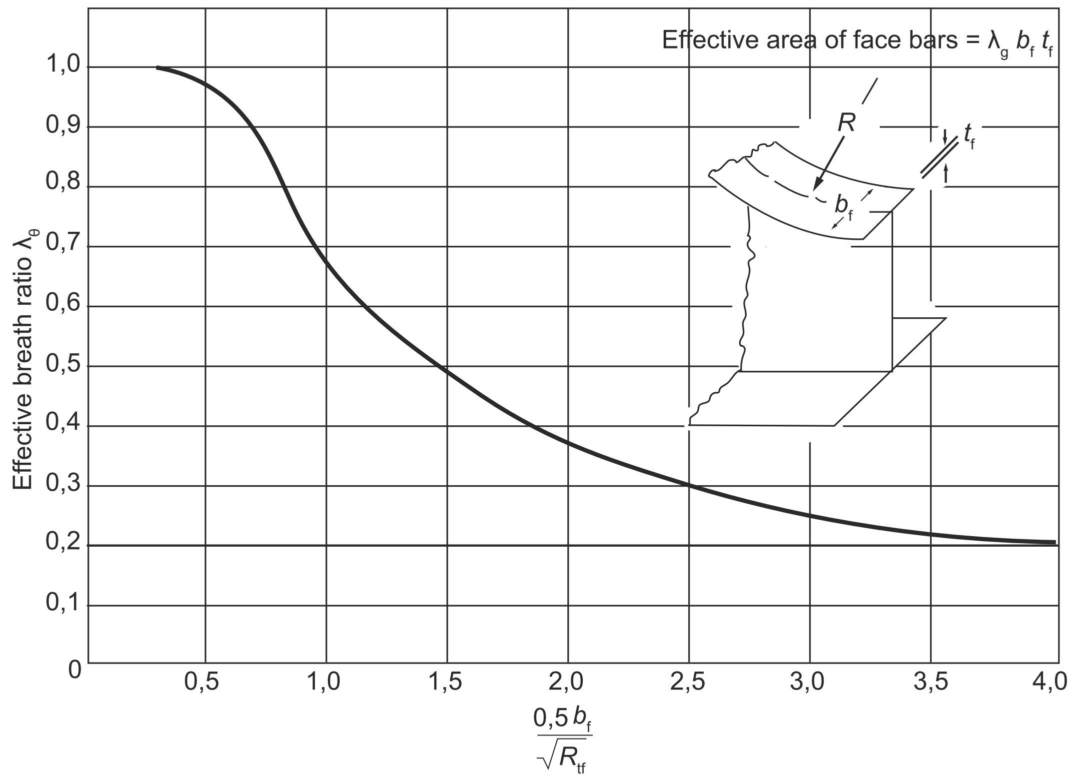
4.5.10 The effects of added mass (i.e. entrained water located outside the dock gate, but which is considered to move with the dock gate) are to be considered using a method which is to be agreed with LR.

4.5.11 A grillage model can be used subject to agreement with LR.

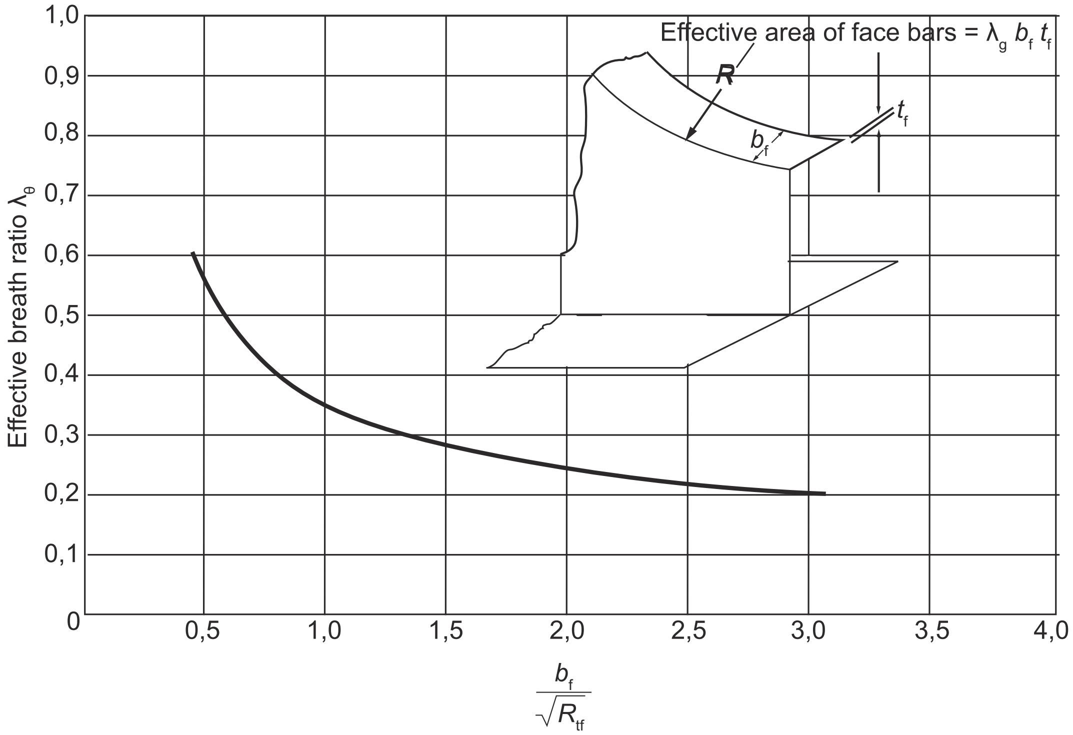
Table 2.4.3 Line element effective cross-section area

Structure represented by element			Effective area, A_e
Primary member face bars	Symmetrical		A_e = 100% A_n
	Asymmetrical		A_e = 100% A_n
Curved bracket face bars (continuous)	Symmetrical		*See Figure 2.4.1 Effective area of face bars*
	Asymmetrical		
Straight bracket face bars (discontinuous)	Symmetrical	Symmetrical	A_e = 100% A_n
	Asymmetrical	Asymmetrical	A_e = 60% A_n
Straight bracket face bars (continuous around toe curvature)	Straight portion	Symmetrical	A_e = 100% A_n
		Asymmetrical	A_e = 60% A_n
	Curved portion	Symmetrical	*See Figure 2.4.1 Effective area of face bars*
		Asymmetrical	

Web stiffeners – sniped both ends	Flat bars	A_e = 20% of stiffener area
	Other sections	$A_e = \dfrac{A}{1+\left(\dfrac{Y_0}{r}\right)^2} - A_p$
Web stiffeners – sniped one end, connected other end	Flat bars	A_e = 75% of stiffener area
	Other sections	$A_e = \dfrac{A}{1+\left(\dfrac{Y_0}{r}\right)^2} - A_p$
Note Consistent units to be used throughout		
Symbols		
A	= cross-section area of stiffener and associated plating	
A_n	= average face bar area over length of line element	
A_p	= cross-section area of associated plating	
I	= cross-section area of associated plating	
Y_0	= moment of inertia of stiffener and associated plating	
r	= radius of gyration = $\sqrt{\dfrac{I}{A}}$	



Effective area of symmetrical face bars



Effective area of asymmetrical face bars

Figure 2.4.1 Effective area of face bars

4.6 Boundary conditions

4.6.1 In general, the dock gate will be supported vertically at the sill base and laterally on two sides. The support will be provided via a soft seal and the stiffness of the seals is to be included in the analysis.

4.6.2 The stiffness and damping characteristics of the seals are to be provided by the gate designer or seal manufacturer together with how these properties can vary around the dock gate perimeter when different seal stiffnesses are specified by the designer. The stiffnesses of seals employed in the structural models are to be consistent with the direction of displacement of the seals, i.e. for translations perpendicular to the compression axis of the seal, shear stiffness of the seal is to be modelled.

4.6.3 The lateral sway of the dock walls should not impose in-plane forces on the dock gate other than those transferred via seal shear stiffness and friction. If there is insufficient edge clearance between the dock walls and the dock gate to ensure that this condition is met, then the interaction between the walls and the dock gate is to be addressed.

4.7 Application of loads

4.7.1 The load scenarios given in *Pt 2, Ch 2, 4.7 Application of loads 4.7.2* to *Pt 2, Ch 2, 4.7 Application of loads 4.7.5* are to be considered where the applied loads are to be taken as the loads given in *Pt 2, Ch 2, 2.1 General* (as appropriate) are to be multiplied by the load factors given in *Pt 2, Ch 2, 4.7 Application of loads 4.7.6* and *Pt 2, Ch 2, 4.7 Application of loads 4.7.7*.

4.7.2 The following load scenarios are to be considered:

(a) normal operating; and
(b) extreme.

4.7.3 The normal operating scenarios comprise the following:

(a) lightweight only;
(b) lightweight + hydrostatic (operating);
(c) lightweight + hydrostatic (operating) + wind;
(d) lightweight + deck loads + hydrostatic (operating);
(e) lightweight + deck loads + hydrostatic (operating) + wind;
(f) lightweight + internal loads;
(g) lightweight + hydrostatic (operating) + internal loads + deck loads + wind; and
(h) lightweight + air pressure test load.

4.7.4 The extreme scenarios comprise the following:

(a) lightweight + deck loads + hydrostatic (maximum credible).

4.7.5 Other load scenarios can be considered at the request of the Owner.

4.7.6 The partial load factors are given in *Table 2.4.4 Partial load factors*.

4.7.7 Consideration can be given to reducing the partial load factors for secondary loads in accordance with BS 6349 Maritime Works. Note that hydrostatic loading is considered to be a primary load.

Table 2.4.4 Partial load factors

Load	Load scenario, *see Pt 2, Ch 2, 4.7 Application of loads 4.7.2*	
	Normal	Extreme
Lightweight	1,35	1,0
Hydrostatic - maximum credible level	N/A	1,35
Hydrostatic - otherwise	1,5	N/A
Deck loading	1,5	1,0
Wind loading	1,35	N/A
Internal loads	1,0	N/A
Test loads	1,0	N/A

4.8 Structural design criteria

4.8.1 The stresses resulting from the application of all load scenarios are not to exceed the following:

- combined stress – 1,0 σ_o;
- direct stress – 0,9 σ_o;
- shear stress – 0,5 σ_o.

σ_o is defined in *Pt 2, Ch 2, 1.4 Materials*.

4.8.2 Stress criteria are based on the coarse mesh described in *Pt 2, Ch 2, 4.5 Modelling 4.5.4*. If a finer mesh is used, then stress can be averaged over an area equal to the size of the coarse mesh element in way of the structure being considered. The averaging is to be based only on elements with their boundary located within the desired area. Stress averaging is not to be carried out across structural discontinuity or abutting structure.

4.8.3 For all load scenarios, except for the extreme load scenarios, plate buckling is to be investigated for all areas of primary structure. The factor against buckling is to be taken as 1,1.

4.8.4 Panel buckling calculations are to be based on the net thickness of the plating.

4.8.5 In general, the applied stresses for buckling assessment are to be increased by a factor equal to the original thickness divided by the thickness after corrosion.

4.8.6 When the calculated elastic critical buckling stress, σ_c, exceeds 50 per cent of the specified minimum yield stress, then the buckling stress is to be adjusted for the effects of plasticity using the Johnson-Ostenfeld correction formula, given below:

- when $\sigma_c \le 0{,}5\sigma_o$

  $\sigma_{cr} = \sigma_o$
- when $\sigma_c > 0{,}5\sigma_o$

$$\sigma_{cr} = \sigma_o\left(1 - \frac{\sigma_o}{4\sigma_c}\right)$$

where

σ_{cr} = the critical buckling stress corrected for plasticity effects, in N/mm^2

σ_c = the elastic critical buckling stress, in N/mm^2

σ_o is defined in *Pt 2, Ch 2, 1.4 Materials*

4.8.7 Deflections of individual panels under lateral hydrostatic loading shall not exceed 1/200 of the principal panel dimension.

4.8.8 Deflections of any stiffener supporting plate subjected to hydrostatic loading shall not exceed 1/200 of the stiffener span.

4.9 Additional requirements for floating dock gates

4.9.1 For floating dock gates with an $L > 6D$, longitudinal strength calculations are to be carried out in accordance with *Pt 3, Ch 4 Pontoons* of the *Rules and Regulations for the Classification of Ships, July 2021*, where the service factor is to be taken as 0,5.

■ *Section 5*
Additional assessments

5.1 Seismic assessment

5.1.1 At the request of the Owner or where required by the local authority, a Seismic Margins Assessment (SMA) is to be carried out in accordance with a recognised national or international standard.

5.1.2 In the assessment for the seismic margins event, some global plastic behaviour can be accepted provided the structural form remains adequate and some structural components can be discarded completely provided viable alternative load paths exist.

Full advantage can be taken of sub-system plastic behaviour provided this does not detract from the strength of any main member. Global stability in all three orthogonal directions is to be provided at all times. Some instability in the vertical direction can be accepted subject to agreement with LR.

5.1.3 A full dynamic analysis is to be carried out and is to model:

- boundary conditions including seal stiffness (and variation in seal stiffness);
- hydrodynamic effects;
- distribution of mass within the structure (recognising the possibility of accidental eccentricity);
- the stiffness of individual members and connections;
- damping consistent with anticipated stress levels;
- input motion defined based on the operating context; and
- whole body displacement.

5.1.4 Where a SMA is required, the margin need not be demonstrated by formal structural analysis. Resistance to structural collapse can be assessed through the demonstration of a ductile response, progressive collapse and use of design details which minimise rupture. Margins in the limit state analysis can be used in the engineering justification.

5.1.5 The dynamic assessment is to utilise modal analysis followed by the evaluation of the forces using the Response Spectrum technique. The treatment of missing mass is to be in accordance with a recognised national or international standard.

5.1.6 The dynamic response of the dock gate will be sensitive to the values used for the stiffness of the seals. The prediction of hydrodynamic effects by use of fluid elements will be sensitive to assumptions made about the distance of the dock gate face to any boundary. Both these effects are to be examined in any analyses by carrying out sensitivity studies within an agreed range, related to the physical constraints on the dock gate.

5.2 Fatigue assessment

5.2.1 At the request of the Owner, a fatigue assessment in accordance with a recognized National or International Standard is to be carried out for all critical components subject to significant cyclical loading. This will apply especially to dock gates provided with roadways.

5.2.2 Consideration should also be given to details subject to small amplitude motions of the pontoon or other buoyant support causing a high number of cycles at low stress levels.

5.3 Impact assessment

5.3.1 At the request of the Owner, an impact assessment is to be carried out in accordance with a recognised national or international standard, to verify that the dock gate is capable of meeting the performance requirements agreed with the Owner. The impact loads are described in *Pt 2, Ch 2, 2.10 Impact*.

5.4 Temperature assessment

5.4.1 At the request of the Owner, a temperature assessment is to be carried out. Note that a stress analysis related to temperature change is not necessary, provided it can be shown that dock gate global expansion/contraction is within the clearance allowed in the restraining slots and provided that global contraction will neither cause the dock gate to come out of its slots nor overload the slots. Calculations undertaken to determine expansion are to account for both global and local differential temperature, and for friction developed against the slots.

■ *Section 6*
Local strength

6.1 General

6.1.1 Plating and supporting stiffeners are to have adequate scantlings to meet the requirements of *Pt 2, Ch 2, 4 Global strength assessment*, and these scantlings are not to be less than the requirements given in this Section. Alternatively, the local scantlings may be determined in accordance with a recognised national or international standard subject to prior agreement being obtained from LR.

6.2 Symbols

6.2.1 The symbols used in this Section are as follows:

s = spacing of secondary stiffeners, in mm

S = spacing or mean spacing of primary members, in metres

ρ = relative density (specific gravity), *see Pt 2, Ch 2, 1.2 Basis of design 1.2.2*

k = local scantling higher tensile steel factor, *see Pt 2, Ch 2, 1.4 Materials*

6.3 Plating

6.3.1 The minimum thickness, in mm, of side shell plating, bottom plating and transverse bulkhead plating is to be not less than the greater of:

(a) $t = 0,004 s f \sqrt{\frac{\rho h k}{1,205}}$ mm

(b) 10 mm

where

f = $1,1 - \frac{s}{2500S}$ but not to be taken greater than 1,0

h = load head, in metres, measured as follows:

(a) For bulkhead plating, the distance from one third above the bottom of the strake of plating to half the height of the overflow above the tank top.

(b) For bottom plating, the distance from the baseline to the maximum operating water level, *see Pt 2, Ch 2, 2.3 Hydrostatic loads*, or the distance from the baseline to half the height of the overflow above the tank top, whichever is the greater.

(c) For side shell plating, the distance from one third above the bottom of the strake of plating to the maximum operating water level, *see Pt 2, Ch 2, 2.3 Hydrostatic loads*, or the distance from the baseline to half the height of the overflow above the tank top, whichever is the greater.

s, S, k and ρ are defined in *Pt 2, Ch 2, 6.2 Symbols 6.2.1*

6.4 Stiffening

6.4.1 The minimum section modulus of rolled or built stiffeners and double plate bulkheads is given by:

$$z = \frac{\rho s k h l_e^2}{88\gamma} \quad \text{cm}^3$$

where

h = load head, in metres, measured as follows:

(a) For bulkhead stiffeners, the distance from the middle of the effective length to half the height of the overflow above the tank top.

(b) For bottom and side shell stiffeners, the distance from the middle of the effective length to the maximum operating water level, *see Pt 2, Ch 2, 2.3 Hydrostatic loads*, or the distance from the baseline to half the height of the overflow above the tank top, whichever is the greater.

γ = 1,4 for rolled or built sections and double plate bulkheads

= 1,6 for flat bars

s, S, k and ρ are defined in *Pt 2, Ch 2, 6.2 Symbols 6.2.1*.

l_e is defined in *Pt 2, Ch 2, 3.3 Structural idealisation 3.3.7*

6.4.2 The minimum inertia of rolled and built stiffeners and double plate bulkheads is given by:

$$I = \frac{2,3}{k} l_e Z \quad \text{cm}^4$$

where Z, k and l_e are defined in *Pt 2, Ch 2, 6.4 Stiffening 6.4.1*.

6.5 Stringers and webs

6.5.1 The minimum section modulus of stringers or webs supporting vertical or horizontal stiffening is given by:

$$Z = 11,7\rho khl_e^2 \text{ cm}^4$$

where ρ, k, h and l_e are defined in *Pt 2, Ch 2, 6.4 Stiffening 6.4.1*.

6.5.2 The minimum inertia of stringers or webs supporting vertical or horizontal stiffening is given by:

$$I = \frac{2,5}{k} l_e Z \quad \text{cm}^4$$

where Z, k and l_e are defined in *Pt 2, Ch 2, 6.5 Stringers and webs 6.5.1*.

6.6 Double plate bulkheads

6.6.1 In addition to the requirements of *Pt 2, Ch 2, 6.4 Stiffening*, the following proportion checks are also to be complied with:

- s/t_p is not to exceed $75\sqrt{k}$ at the top and $65\sqrt{k}$ at the bottom;
- d/t_w is not to exceed $85\sqrt{k}$ at the top and $75\sqrt{k}$ at the bottom;
- d is not to be less than $39 l_e$; and
- A_w is to be less than $\frac{0,07Z}{l_e}$ at the top and $\frac{0,10Z}{l_e}$ at the bottom.

where

A_w is the shear area, in cm^2, of the webs of the double plate bulkhead

t_w, t_p and d are defined in *Figure 2.3.1 Double plate bulkhead dimensions*

s is defined in *Pt 2, Ch 2, 6.2 Symbols 6.2.1*

6.6.2 The plating thickness at the middle of span l_e of corrugated or double plate bulkheads is to extend not less than $0,2 l_e$ m above mid span.

6.7 Pillars

6.7.1 Pillars are to comply with the requirements of *Table 2.6.1 Pillars*.

6.7.2 Pillars are to be fitted in the same vertical line wherever possible, and effective arrangements are to be made to distribute the load at the heads and heels of all pillars. Where pillars support eccentric loads, they are to be strengthened for the additional bending moment imposed upon them.

6.7.3 Tubular and hollow square pillars are to be attached at their heads to plates supported by efficient brackets, in order to transmit the load effectively. Doubling or insert plates are to be fitted under the heels of tubular or hollow square pillars, and to decks under large pillars. The pillars are to have a bearing fit and are to be attached to the head and heel plates by continuous welding. At the heads and heels of pillars built of rolled sections, the load is to be well distributed by means of longitudinal and transverse brackets.

6.7.4 Where pillars are not directly above the intersection of plate floors and girders, partial floors and intercostals are to be fitted as necessary to support the pillars. Manholes are not to be cut in the floors and girders below the heels of pillars. Where longitudinal framing is adopted, equivalent stiffening under the heels of pillars is to be provided, and where the heels of pillars are carried on a tunnel, suitable arrangements are to be made to support the load.

6.7.5 Where pillars are fitted inside tanks, the tensile stress in the pillar and its end connections is not to exceed 108 N/mm^2 at the test heads. In general, such pillars should be of built sections, and end brackets may be required.

6.7.6 Pillars are to be fitted below windlasses, winches, capstans and elsewhere where considered necessary.

Table 2.6.1 Pillars

Symbols	Parameter	Requirement
b = breadth of side of a hollow rectangular pillar or breadth of flange or web of a built or rolled section, in mm d_p = mean diameter of tubular pillars, in mm	(1) Cross-sectional area of all types of pillar	$A_p = \dfrac{kP}{12,36 - 51,5\dfrac{l_e}{r\sqrt{k}}}$ cm^2 *See* Note
k = local scantling higher tensile steel factor, *see Pt 2, Ch 2, 1.4 Materials*, but not less than 0,72 l = overall length of pillar, in metres l_e = effective length of pillar, in metres, and is taken as: for hold pillars 0,65l for 'tween deck pillars 0,80l l_p = distance, in metres, between centres of two adjacent spans of girders or transverses supported by the pillar	(2) Minimum wall thickness of tubular pillars	The greater of the following (a) $t = \dfrac{P}{d_p\left(0,392 - 1,53\dfrac{l_e}{r}\right)}$ mm (b) $t = \dfrac{d_p}{40}$ mm but not to be less than (c) t = 5,5 mm where L < 90 m or t = 7,5 mm where $L \geq$ 90 m
r = least radius of gyration of pillar cross-section, in mm, and may be taken as: $r = 10\sqrt{\dfrac{1}{A_p}}$ A_p = cross-sectional area of pillar, in cm^2 C = stowage rate, in m^3/t to be taken as 1,39 S = spacing or mean spacing of primary members, in metres H_g = deck loading, in kN, see Pt 2, Ch 2, 2.4 Deck loading	(3) Minimum wall thickness of hollow rectangular pillars or web plate thickness of *I* or channel sections	The lesser of (b) and (c) and not to be less than (a): (a) $t = \dfrac{P}{d_p\left(0,392 - 1,53\dfrac{l_e}{r}\right)}$ mm (b) $t = \dfrac{br}{600l_e}$ mm (c) $t = \dfrac{b}{55}$ mm but not to be less than t = 5,5 mm where L < 90 m or t = 7,5 mm where $L \geq$ 90 m
I = least moment of inertia of cross-section, in cm^4 P = load, in kN, supported by the pillar and is to be taken as $\dfrac{SH_g l_p}{C} + p_a$ but not less than 19,62 kN	(4) Minimum thickness of flanges of angle or channel sections	The lesser of the following: (a) $t_f = \dfrac{br}{200l_e}$ mm (b) $t_f = \dfrac{b}{18}$ mm
P_a = load, in kN, from pillar or pillars above (zero if no pillars over)	(5) Minimum thickness of flanges of built or rolled *I* sections	The lesser of the following: (a) $t_f = \dfrac{br}{400l_e}$ mm (b) $t_f = \dfrac{b}{36}$ mm

Note As a first approximation A_p can be taken as $\sqrt{\frac{kP}{9,32}}$ and the radius of gyration estimated for a suitable section having this area.

Note If the area calculated using this radius of gyration differs by more than 10 per cent from the first approximation, a further calculation using the radius of gyration corresponding to the mean area of the first and second approximation is to be made.

6.7.7 Where truss arrangements, comprising top and bottom girders in association with pillars and diagonal bracing, are used in the support of the deck loads, the diagonal members are generally to have angles of inclination with the horizontal of about 45° and cross-sectional area of approximately 50 per cent of the adjacent pillar in accordance with *Table 2.6.1 Pillars*.

6.8 Roadways

6.8.1 The scantlings and supporting arrangements of roadways are to be in accordance with the requirements of *Pt 3, Ch 5 Bridge/Vehicle Ramp Strength* of the *Rules and Regulations for the Classification of Linkspans, July 2021*, *see also Pt 2, Ch 2, 2.4 Deck loading*.

6.9 Design of supporting devices

6.9.1 Mitre and flap gates are to be provided with adequate means of closing and supporting which are to be commensurate with the strength and stiffness of the surrounding structure. The strength of the dock bottom/sides and connection with the closing and supporting devices (i.e. interface works) are not included in the scope of classification.

6.9.2 Closing and supporting devices are to be designed to withstand the forces the dock gate is subjected to in the closed position, *see Pt 2, Ch 2, 2 Loading*, using the following permissible stresses:

$$\tau = \frac{80}{k} \text{ N/mm}^2$$

$$\sigma = \frac{120}{k} \text{ N/mm}^2$$

$$\sigma_e = \frac{150}{k} \text{ N/mm}^2$$

6.9.3 The arrangement of securing and supporting devices is to be such that threaded bolts are not to carry support forces. The maximum tensile stress in way of threads of bolts, not carrying support forces, is not to exceed:

$$\sigma = \frac{125}{k} \text{ N/mm}^2$$

6.9.4 For steel to steel bearings in securing and supporting devices, the nominal bearing pressure is not to exceed $0,8\sigma_o$. For other bearing materials, the permissible bearing pressure is to be determined according to the manufacturer's specification. The nominal bearing pressure is to be calculated by dividing the design force by the projected bearing area.

6.9.5 The distribution of the reaction forces acting on the supporting devices is to be supported by direct calculations taking into account the flexibility of the dock gate structure and the actual position and stiffness of the supports.

■ *Section 7*
Towing and lifting arrangements

7.1 Application

7.1.1 Where it is intended to transport a dock gate by means of towing or where the dock gate will be lifted into place, the strength of fittings and supporting hull structures are to be assessed in accordance with the requirements of this Chapter.

7.1.2 The arrangements, equipment and fittings of sufficient safe working load are to be provided to enable the safe conduct of all towing and lifting operations.

7.1.3 Fittings means bollards and bitts, fairleads, stand rollers, chocks used for the towing of the dock gate, and padeyes, lifting lugs, etc. used for the lifting of the dock gate. Any weld or bolt or equivalent device connecting the fitting to the supporting structure is part of the shipboard fitting. Other components such as capstans, winches, etc. are not covered by this Chapter.

7.1.4 Supporting structures means that part of the dock gate on/in which the fitting is placed and which is directly submitted to the forces exerted on the fitting. The supporting structure of capstans, winches, etc. used for towing operations mentioned above is also to comply with the requirements specified in this Chapter.

7.2 Towing

7.2.1 The strength of fittings used for normal towing operations at bow, sides and stern and their supporting hull structures are to comply with the requirements specified in this sub-Section.

7.2.2 Fittings for towing are to be located on stiffeners and/or girders which are part of the deck construction so as to facilitate efficient distribution of the towing load. Other arrangements are acceptable, provided that the strength is confirmed adequate for the intended service.

7.2.3 The design load applied to fittings and supporting hull structure is not to be less than 1,25 times the intended maximum towing load (e.g. static bollard pull) as indicated on the towing arrangements plan.

7.2.4 When a safe towing load TOW greater than that determined according to *Pt 2, Ch 2, 7.2 Towing 7.2.16* is requested, then the design load is to be increased in accordance with the appropriate TOW/design load relationship given in this Section.

7.2.5 The side projected area is to be considered for selection of towing lines and the loads applied to fittings and supporting hull structure.

7.2.6 The increase of the minimum breaking strength for synthetic ropes need not to be considered for the loads applied to fittings and supporting hull structure.

7.2.7 The design load is to be applied to fittings in all directions that could occur by considering the arrangement shown on the towing and mooring arrangements plan. Where the towing line takes a turn at a fitting, the total design load applied to the fitting is equal to the resultant of the design loads acting on the line, *see Figure 2.7.1 Design load applied to fittings*. However, in no case does the design load applied to the fitting need to be greater than twice the design load on the line.

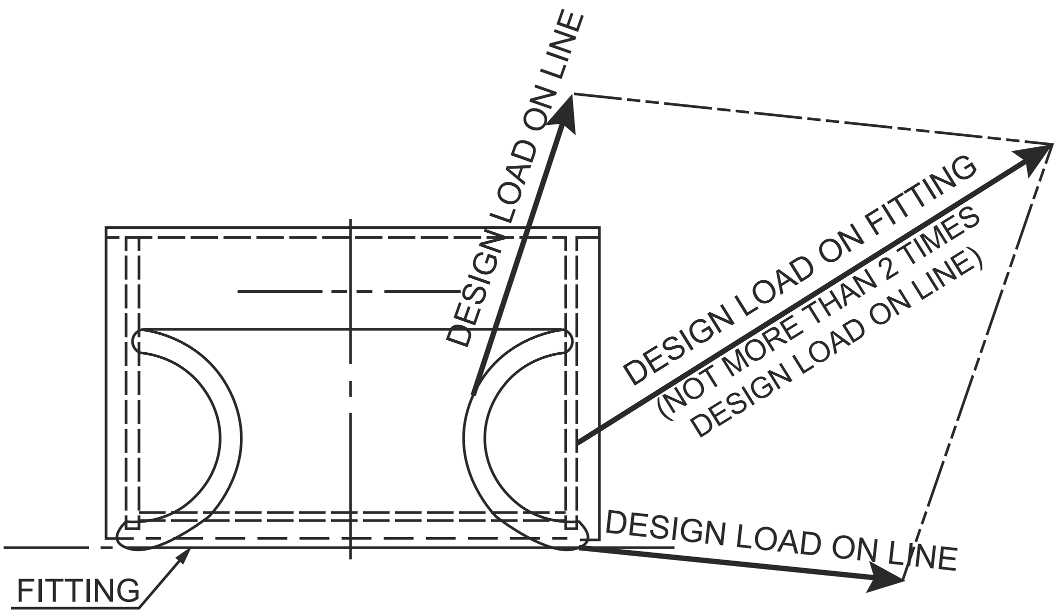


Figure 2.7.1 Design load applied to fittings

7.2.8 Fittings are to be selected from an acceptable National or International standard and to be based on the intended maximum towing load (e.g. static bollard pull) as indicated on the towing arrangements plan.

7.2.9 Towing bitts (double bollards) are to be chosen for the towing line attached with an eye splice if the industry standard distinguishes between different methods to attach the line, i.e. figure of eight or eye splice attachment.

7.2.10 When the fitting is not selected from an accepted industry standard, the strength of the fitting based on net scantlings and its attachment to the dock gate is to be adequate for the loads specified in *Pt 2, Ch 2, 7.2 Towing 7.2.3* based on the acceptance criteria given in *Pt 2, Ch 2, 7.2 Towing 7.2.10* or *Pt 2, Ch 2, 7.2 Towing 7.2.11* as appropriate. Towing bitts (double bollards) are required to resist the loads caused by the towing line attached with an eye splice. For strength assessment, beam theory or finite element analysis using net scantlings is to be applied, as appropriate. Corrosion additions and wear down allowance is to be added to the net scantlings as defined in *Pt 2, Ch 2, 7.2 Towing 7.2.13* and *Pt 2, Ch 2, 7.2 Towing 7.2.15*.

7.2.11 The net scantlings of the supporting structure for the fittings are to be adequate for the loads specified in *Pt 2, Ch 2, 7.2 Towing 7.2.3* based on the acceptance criteria given in *Pt 2, Ch 2, 7.2 Towing 7.2.11* or *Pt 2, Ch 2, 7.2 Towing 7.2.12* as appropriate. The reinforced members beneath fittings are to be effectively arranged for any variation of direction (horizontally and vertically) of the towing forces acting upon the fittings, *see Figure 2.7.2 Supporting hull structure* for a sample arrangement. Proper alignment of the fitting and its supporting hull structure is to be ensured. The acting point of the towing force on a fitting is to be taken at the attachment point of a towing line or at a change in its direction. For bollards and bitts, the attachment point of the towing line is to be taken not less than 4/5 of the tube height above the base as indicated in *Figure 2.7.2 Supporting hull structure*. Corrosion additions and wear down allowance is to be added to the net scantlings as defined in *Pt 2, Ch 2, 7.2 Towing 7.2.13* and *Pt 2, Ch 2, 7.2 Towing 7.2.15*.

7.2.12 In the case of strength assessment using beam theory or grillage analysis, the stress within the supporting structure of fittings is not to exceed that given in *Table 2.7.1 Allowable stress within the supporting structure of fittings*.

7.2.13 For strength calculations by means of finite element analysis, the geometry is to be idealised as realistically as possible. The ratio of element length to width is not to exceed 3. Girders are to be modelled using shell or plane stress elements. Symmetric girder flanges are generally to be modelled by beam or truss elements. At least three elements are to be used across the depth of the girder. In way of small openings in girder webs the web thickness is to be reduced to a mean thickness over the web height. Large openings are to be modelled. Stiffeners are generally to be modelled by using shell, plane stress, or beam elements. Stresses are to be read from the centre of the individual element. For shell elements the stresses are to be evaluated at the mid-plane of the element. The equivalent stress within the supporting structure of fittings is not to exceed the specified minimum yield strength of the material.

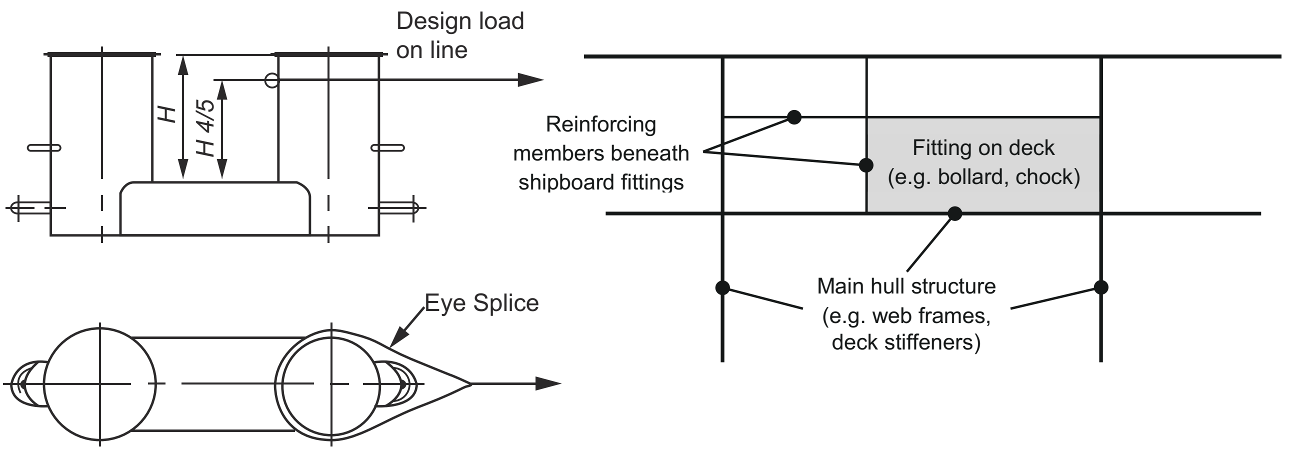


Figure 2.7.2 Supporting hull structure

7.2.14 An allowance for corrosion is to be added to the net thickness derived as indicated below:

- For the supporting structure, a corrosion addition of 2 mm is to be added to the net thickness derived.
- For pedestals and foundations on deck which are not part of a fitting according to an accepted industry standard, 2,0 mm.
- For shipboard fittings not selected from an accepted industry standard, 2,0 mm.

Table 2.7.1 Allowable stress within the supporting structure of fittings

	Normal stress, in N/mm^2	Shear stress, in N/mm^2
Allowable stress	$\frac{235}{k}$	$\frac{141}{k}$

where

$k = \frac{235}{\sigma_o}$

σ_o = specified minimum yield strength of the material in N/mm^2

Note Normal stress is defined as the sum of bending and axial stresses. No stress concentration factors are accounted for and as such may need to be considered separately.

7.2.15 In addition to the corrosion addition given in *Pt 2, Ch 2, 7.2 Towing 7.2.13*, the wear allowance, t_w, for fittings that are not selected from an acceptable National or International Standard, is not to be less than 1,0 mm, added to surfaces which are intended to regularly contact the line.

7.2.16 The safe towing load (TOW) is the load limit for towing purposes. TOW used is not to exceed 80 per cent of the design load specified by *Pt 2, Ch 2, 7.2 Towing 7.2.3*.

7.2.17 TOW, in tonnes, of each fitting is to be marked (by weld bead or equivalent) on the deck fittings used for towing.

7.2.18 The above requirements on TOW apply for the use with no more than one towline. If not otherwise chosen, for towing bitts (double bollards) TOW is the load limit for a towing line attached with an eye-splice.

7.2.19 The towing and lifting arrangements plan mentioned in *Pt 2, Ch 2, 7.4 Towing and lifting arrangements plan* is to define the method of use of towing lines.

7.3 Lifting

7.3.1 The strength of fittings used to lift a dock gate in and out of water and their supporting hull structures are to comply with the requirements of this sub-Section.

7.3.2 Padeyes and lifting lugs are to be located on stiffeners and/or girders which are part of the deck construction so as to facilitate efficient distribution of the lifting load. Other arrangements are acceptable, provided that the strength is confirmed adequate for the intended service.

7.3.3 The provision of padeyes is to be such that a uniform lift is achieved with no off-centre loading of the lifting appliance occurring.

7.3.4 The design of padeyes is to be in accordance with a recognised national or international standard.

7.3.5 The padeye can be manufactured from one single plate, have a cheek plate fillet welded on each side of the plate or have a boss which is fillet welded through the plate, *see Figure 2.7.3 Acceptable padeye design*. Padeyes where the boss is only partly welded to the plate are not permitted.

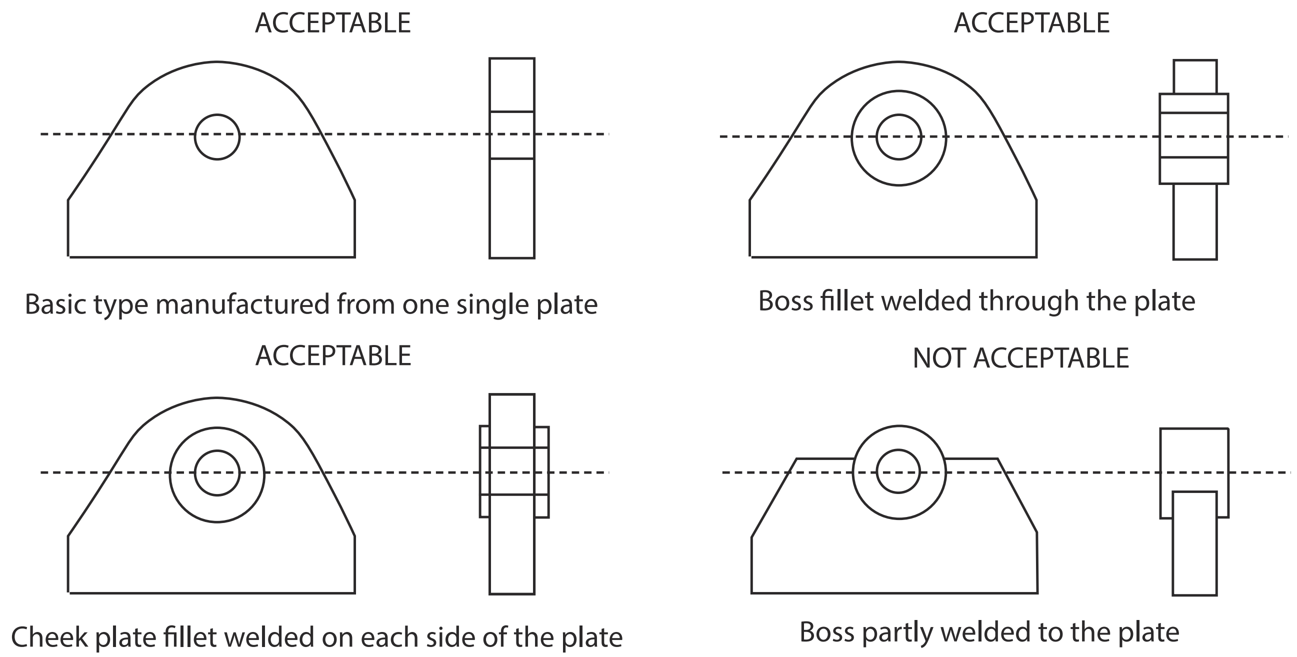


Figure 2.7.3 Acceptable padeye design

7.3.6 All padeyes and lifting lugs are to be marked with their specific SWL. The locations and SWL of the padeyes and lifting lugs is to be recorded on the towing and lifting arrangement plan.

7.3.7 All padeyes and lifting lugs are to be tested to 1,5 times the SWL, as a vertical load only.

7.3.8 The net scantlings of supporting structures are to be assessed in accordance with *Pt 2, Ch 2, 7.2 Towing 7.2.9* to *Pt 2, Ch 2, 7.2 Towing 7.2.12* where the design load is to be taken as the SWL of the padeye and the acceptance criteria are given in *Table 2.7.2 Allowable stress within the supporting structure of padeyes*. The reinforced members beneath the padeye are to be effectively arranged for any variation of direction (horizontally and vertically) of the lifting forces acting upon the padeye. Corrosion additions and wear down allowance is to be added to the net scantlings as defined in *Pt 2, Ch 2, 7.2 Towing 7.2.13*.

Table 2.7.2 Allowable stress within the supporting structure of padeyes

	Normal stress, in N/mm^2	Shear stress, in N/mm^2
Allowable stress	$\frac{157}{k}$	$\frac{94}{k}$
where $k = \frac{235}{\sigma_o}$ σ_o = specified minimum yield strength of the material in N/mm^2 **Note** Normal stress is defined as the sum of bending and axial stresses. No stress concentration factors are accounted for and as such may need to be considered separately.		

7.3.9 The global strength of the dock gate (longitudinal and transverse) during lifting operations is to be assessed taking into account the hoisting speed of the lifting appliance, the stiffness of the wires, the residual weights, liquids, etc, on the pontoon and the distribution of the padeyes.

7.4 Towing and lifting arrangements plan

7.4.1 The SWL and TOW for the intended use for each shipboard fitting is to be noted in the towing and lifting arrangements plan which is to be made available for towing and lifting operations. It is to be noted that TOW is the load limit for towing purposes and SWL that for lifting purposes.

7.4.2 Information provided on the plan is to include in respect for each shipboard fitting:

(a) location on the pontoon;
(b) fitting type;
(c) SWL/TOW;
(d) manner of applying towing line load, including limiting fleet angles; and
(e) manner of applying lifting load, including limiting angles.

Note that item (c) is subject to approval. Fleet angle is defined as the maximum angle the line deviates from a direction perpendicular to the drum axis of a towing winch. The limiting angles for the purposes of lifting are defined as the maximum angles assumed in the derivation of the SWL for each padeye.

7.4.3 The above information as given in *Pt 2, Ch 2, 7.4 Towing and lifting arrangements plan 7.4.2* for towing operations is to be incorporated into the pilot card in order to provide the pilot with proper information on towing operations.

■ *Section 8* Testing

8.1 Floating dock gates

8.1.1 Floating dock gates are to be tested in accordance with the requirements of *Pt 2, Ch 1, 7 Testing*.

8.1.2 Ballast tanks emptied by air pressure are to be tested to the setting pressure of the safety valves.

8.1.3 Where necessary, additional temporary supports are to be fitted to the dock gate to prevent excessive deformation.

8.2 Other dock gates

8.2.1 Non-floating dock gates are to be structurally tested to a head of water corresponding to the depth of the dry dock.

■ *Section 9* Construction

9.1 Welding

9.1.1 Welding is to be in accordance with the requirements of *Pt 2, Ch 1, 8 Welding*.

9.2 Non-Destructive Examination

9.2.1 Non-Destructive Examination (NDE) is to be carried out in accordance with the requirements of the *Rules for the Manufacture, Testing and Certification of Materials, July 2021*.

9.2.2 All critical joints identified by the designer in the NDE plan are to be subject to volumetric and surface NDE as appropriate.

9.2.3 All butt welds in the dock gate plating in the vertical direction shall be subject to 100 per cent NDE.

9.2.4 Other butt welds subject to high in-plane tension shall be identified by the design and included in the NDE plan and subject to 100 per cent NDE.

9.2.5 Main deck and keel to dock gate sides full penetration connections, are to be subject to 100 per cent NDE.

9.2.6 Critical fillet welds subject to high stress shall be identified by the designer and included in the NDE plan and subject to 100 per cent NDE.

9.2.7 Fillet welds shall be subject to a random 10 per cent NDE of weld length agreed with the attending Surveyor.

9.3 Tolerances

9.3.1 The overall dimensions of the dock gate are to be agreed with the designer and dock Operator.

9.3.2 Tolerances for width, planer deviation and twist are to be compatible with the seal design requirements.

9.3.3 All other tolerances are to be in accordance with BS EN 1090-2 *Technical requirements for the execution of steel structures*.

9.3.4 For dock gates protecting nuclear vessels, there is a formal requirement on the part of the fabricator to demonstrate tolerances and record the results. The required execution class in accordance with BS EN 1990 *Eurocode – Basis of structural design* is:

- EXC4 for dock gates protecting nuclear vessels.
- EXC3 for other dock gates.

■ *Section 10* Access arrangements

10.1 General

10.1.1 Dock gates are to be provided with adequate access routes into and throughout the interior for inspection, maintenance and repair. Safe and serviceable means of entry and access shall be provided by hatches, ladders and walkways, etc. At least two independent means of entry and exit will be required for the dock gate.

10.1.2 Adequate ventilation shall be provided to support safe access. A free flow of air is to be maintained at all times. Where required, this is to be provided by mechanically driven fans. Arrangements are to be provided to facilitate a gas free condition prior to human entry.

10.1.3 Handrails are to be provided:

- Where pedestrian access is allowed; and
- Around external and internal openings on and in the dock gate.

10.1.4 Handrails are be fabricated from steel in accordance with a recognised national or international standard. The height of the top rail is to be at least 1,1 m above the walkway. An intermediate rail at approximately mid height is to be provided and a continuous toe board at least 150 mm high incorporating drainage holes installed at walkway level.

■ *Section 11* Dock gate seals

11.1 General

11.1.1 The seal material is to be durable and resistant to degradation from the natural environment and from marine flora and fauna.

11.1.2 The seal attachment is to be designed to facilitate replacement.

11.1.3 Where rubber seals are adopted, corrosion resistant nickel copper alloys are to be used. The studs are to have a service life comparable to the rubber seal. Alloy studs are to be suitably protected from galvanic corrosion. Robust fixing is required to prevent seal detachment during undocking. Rubber seals shall be bedded in an elastomeric adhesive which is spread continuously over all of the supporting surface.

11.1.4 Where timber is used, it shall comply with a recognised national or international standard. Greenheart is recommended for use in dock gates. Where used in short lengths particular attention is to be paid to scarf details. Machining of the timber will be required to achieve straightness and a suitable surface finish. The timbers are to be bedded in flexible material to achieve the required tolerance.

11.1.5 The accuracy of fit between the seals and the slots is excluded from the scope of classification.

11.1.6 The leakage performance of the sealing arrangement is excluded from the scope of classification, however, an acceptable level of leakage is to be agreed with the dockyard Operator and recorded in the operational data for the dock gate.

Section
1 General requirements

2 Pumps, water service pipes, hydrants and hoses

3 Fire detection and fire-extinguishing systems and equipment

4 Fire pumps and water service pipes

5 Fire protection

■ *Section 1* General requirements

1.1 General

1.1.1 The requirements of this Chapter apply to floating docks intended for service at remote locations where there is no provision for rapid attendance by a permanently available, professional fire service. However, where such provision can be shown to exist in the service area, consideration will be given to the acceptance of arrangements equivalent to those required by these Rules, taking into account the effective contribution to fire-fighting which can be made by the fire service.

1.1.2 The requirements of this Chapter apply to the minimum fire protection, detection and extinction for floating docks and do not cover equipment fitted for fighting fires that may occur on ships in the dock.

1.1.3 Attention should also be given to any relevant statutory requirements of the National Authority of the country in which the floating dock is to operate. Compliance with such statutory requirements may, at the discretion of the Committee, be accepted as meeting the requirements of this Chapter.

1.1.4 Consideration will be given to special cases where the arrangements are equivalent to the requirements of this Chapter.

1.1.5 Fire-fighting appliances (hoses, extinguishers, gas cylinders, emergency pumps, etc.) which have been approved by a National Authority as complying with the regulations of the International Convention for Safety of Life at Sea, 1974, may be accepted as meeting the requirements of this Chapter.

1.1.6 Where it is proposed to apply a remote centralized control system for the essential machinery of 1000 bhp and over, and it is intended that the engine and/or boiler rooms will not be continuously manned, an approved fire detection system in accordance with *Pt 2, Ch 3, 3.7 Fire detection systems* is to be provided in these spaces.

1.2 Plans required

1.2.1 The following plans are to be submitted for approval:

(a) A general arrangement plan showing the disposition of all fire-fighting equipment and fire-extinguishing systems.
(b) A plan showing the layout and construction of the fire main including pumps, hydrants, valves, etc.
(c) A plan of the fixed fire-extinguishing system in the machinery spaces.
(d) A plan of the structural fire bulkheads and decks arrangement and means of escape.

■ *Section 2* Pumps, water service pipes, hydrants and hoses

2.1 Total capacity of fire pumps

2.1.1 The fire pumps are to be capable of developing the pressures in the fire main as required by *Pt 2, Ch 3, 2.3 Pressure in the fire main*.

2.2 Fire pumps

2.2.1 Sanitary, ballast, bilge or general service pumps may be accepted as fire pumps, provided that they are not normally used for pumping oil and, if they are subject to occasional duty for the transfer or pumping of fuel oil, that suitable changeover arrangements are fitted.

2.2.2 Any pump designated as a fire pump (other than any emergency pump required by *Pt 2, Ch 3, 4.1 General 4.1.4*) is to have a capacity not less than 80 per cent of the total required capacity divided by the number of required fire pumps, and in any event is to be capable of delivering at least the two required jets of water. Any deficiency in capacity of one of the fire pumps is to be made good by excess capacity of the other fire pumps. These fire pumps are to be capable of supplying the fire main system under the required conditions. Where more pumps than required are installed, their capacities will be specially considered.

2.2.3 Relief valves are to be provided in conjunction with all fire pumps if the pumps are capable of developing a pressure exceeding the design pressure of the water service pipes, hydrants and hoses. These valves are to be so placed and adjusted as to prevent excessive pressure in any part of the fire main system.

2.3 Pressure in the fire main

2.3.1 The fire pumps, associated piping and fire main are to be so designed that a minimum pressure can be maintained sufficient to produce a 12,2 m jet throw through adjacent nozzles of sizes required by *Pt 2, Ch 3, 2.8 Nozzles*. It should be noted that the minimum pressure required is to be obtained at the top deck when the floating dock is in the fully raised position.

2.4 Fire main

2.4.1 The diameter of the fire main is to be based on the required capacity of the fire pump or pumps, and the diameters of the water service pipes are to be sufficient to ensure an adequate supply of water for the simultaneous operation of at least two fire hoses using any of the hydrants provided in accordance with these Rules. In general, the diameter of the fire main should be not less than that required by the following formula, but in no case is it to be less than 50 mm:

$$d = \frac{L_{\text{D}}}{1,2} + 25 \text{ mm}$$

where

d = internal diameter of the fire main, in mm

L_{D} = Rule length of the floating dock, in metres

= The diameter of the fire main need not exceed 127 mm.

2.4.2 The fire main is to be situated outside the machinery spaces, and the discharge line or lines from the fire pumps are to be fitted with isolating valves at the connections to the fire main.

2.4.3 The wash deck line may be used as a fire main provided that the requirements of this Section are satisfied.

2.4.4 All water pipes for fire-extinguishing are to be provided with drain valves for use in frosty weather.

2.5 Number and position of hydrants

2.5.1 The number and position of the hydrants are to be such that at least two jets of water not emanating from the same hydrant, one of which is to be from a single length of hose, may reach any part of the floating dock under any operating conditions.

2.5.2 In spaces containing machinery with a total power of 1000 bhp and over, two hydrants are to be provided, and in spaces where the total power of the machinery is less, one hydrant will be accepted.

2.5.3 Where, in either the case of *Pt 2, Ch 3, 2.5 Number and position of hydrants 2.5.1* or *Pt 2, Ch 3, 2.5 Number and position of hydrants 2.5.2*, fire-fighting from within a small compartment is impracticable due to limitations in space, the hydrants required may be situated outside and adjacent to the compartment entrance.

2.6 Pipes and hydrants

2.6.1 Materials readily rendered ineffective by heat are not to be used for fire mains. Where steel pipes are used they are to be galvanized internally and externally. Cast iron pipes are not acceptable. The pipes and hydrants are to be so placed that the fire-hoses may be easily coupled to them. The positions of the hydrants are to be such that they are always readily accessible and the

pipes are to be arranged so far as practicable to avoid risk of damage. Unless there is provided one hose and nozzle for each hydrant in the floating dock, there shall be complete interchangeability of hose couplings and nozzles.

2.6.2 Valves or cocks are to be fitted in such positions on the pipes that any of the fire-hoses may be removed while the fire pumps are at work.

2.7 Fire-hoses

2.7.1 Fire-hoses are to be of seamless hemp, close weave flax canvas, or other approved material. The hoses are to be sufficient in length to project a jet of water to any of the spaces in which they may be required to be used. Their length, in general, is not to exceed 18,3 m. Each hose is to be provided with a nozzle and the necessary couplings. Fire-hoses, together with any necessary fittings and tools, are to be kept ready for use in conspicuous positions near the water service hydrants or connections.

2.8 Nozzles

2.8.1 The nozzles used for extinguishing fires other than oil fires are to have a bore of not less than 12 mm. For accommodation and service spaces, a nozzle size of 12 mm will normally be adequate, but for machinery spaces and exterior locations 12, 16 or 20 mm nozzles may be adopted so as to make full use of the maximum discharge capacity of the fire pumps. The jet throw at any nozzle is to be about 12,2 m. Dual purpose nozzles for jet or fog may be adopted.

■ *Section 3*
Fire detection and fire-extinguishing systems and equipment

3.1 Fire-extinguishers (portable and non-portable)

3.1.1 All fire-extinguishers are to be approved types. If considered necessary, the Committee may require the makers to produce evidence from a recognized independent testing authority regarding the suitability of their appliances.

3.1.2 The extinguishers required for use in the machinery spaces of floating docks burning oil as fuel are to be of a type discharging froth, carbon dioxide gas, dry powder, or other approved medium suitable for extinguishing oil fires. Fire-extinguishers containing an extinguishing medium which either itself or when in use gives off gases harmful to persons are not to be used. For radio rooms and switchboards, extinguishers containing not more than 1,136 litres of carbon tetrachloride or similar media may be permitted subject to such extinguishers being additional to any required by *Pt 2, Ch 3, 4 Fire pumps and water service pipes*.

3.1.3 The capacity of required portable fluid extinguishers is not to be more than 13,5 litres and not less than 9 litres. Other extinguishers are not to be in excess of the equivalent portability of the 13,5 litre fluid extinguisher and are not to be less than the fire-extinguishing equivalent of a 9 litre fluid extinguisher.

3.1.4 A spare charge is to be provided for each required fire-extinguisher which can be readily re-charged on board. If this cannot be done, duplicate extinguishers are to be provided.

3.1.5 One of the portable fire-extinguishers intended for use in any space is to be stowed near the entrance to that space.

3.2 Acceptable equivalents

3.2.1

FROTH	CARBON DIOXIDE
136 litres	45 kg
45 litres	16 kg
Portable	4,5 kg

3.3 Fire-smothering gas for machinery spaces

3.3.1 Where provision is made for the injection of gas into machinery spaces for fire-extinguishing purposes, the necessary pipes for conveying the gas are to be provided with control valves or cocks which are to be so placed that they will be easily accessible and not readily cut-off from use by an outbreak of fire. These control valves or cocks are to be so marked as to indicate

clearly the compartments to which the pipes are led. Suitable provision is to be made to prevent inadvertent admission of the gas to any compartment.

3.3.2 The piping is to be of adequate size and so arranged as to provide effective distribution of fire-smothering gas. Steel distribution pipes are to be galvanized internally and externally, and are not to be smaller than 20 mm bore for carbon dioxide.

3.4 Carbon dioxide gas

3.4.1 Where carbon dioxide is used as an extinguishing medium for spaces containing boilers, engines or gas turbines, the quantity of gas carried is to be sufficient to give a minimum volume of free gas equal to the larger of the following:

(a) 40 per cent of the gross volume of the largest space, the volume to include the casing up to the level at which the horizontal area of the casing is 40 per cent or less of that of the space concerned; or
(b) 35 per cent of the entire volume of the largest space including the casing.

When evaluating the quantity of carbon dioxide gas required for the machinery spaces, the free air content of the starting air receivers is to be added to the above gross space volumes. The volume of gas is to be calculated at 0,56 m^3/kg.

3.4.2 Where carbon dioxide is used as the extinguishing medium for spaces containing boilers, engines or gas turbines, the fixed piping system is to be such that 85 per cent of the gas can be discharged into the space within two minutes.

3.4.3 The gas cylinders and main controls are to be located to the Surveyor’s satisfaction in a cool and well ventilated position, not likely to be made inaccessible by fire. Provision is to be made for changing the cylinders and checking their contents by weighing or other approved means. Operating instructions are to be displayed at the controls.

3.5 Audible alarms

3.5.1 Means are to be provided whereby audible warning is given automatically before fire-smothering gas can be released into the machinery space and any other working space.

3.6 Fixed froth fire-extinguishing system

3.6.1 Any required fixed froth fire-extinguishing system is to be able to discharge a quantity of froth sufficient to cover to a depth of 150 mm the largest area over which fuel oil is liable to spread.

3.6.2 Such a system is to be controlled from an easily accessible position or positions, outside the space to be protected, which will not be readily cut-off by an outbreak of fire. The distribution pipes are to be of steel, galvanized internally and externally.

3.7 Fire detection systems

3.7.1 All required fire detection systems are to be capable of automatically indicating the presence or inception of fire and its location. Indicators are to be centralized in control stations. The indicators may be distributed among several stations subject to approval by the Surveyor.

3.7.2 Electrical equipment used in the operation of required fire detection systems is to have two separate sources of power, one of which should be an emergency source.

3.7.3 The alarm system is to operate both audible and visible signals at the main stations referred to in *Pt 2, Ch 3, 3.7 Fire detection systems 3.7.1*. Where it is intended that the engine and/or boiler rooms will not be continuously manned, the alarm system is to operate both audible and visible signals at the station from which the machinery is controlled.

3.8 Fixed pressurized water-spraying systems for engine rooms and boiler rooms

3.8.1 Fixed pressurized water-spraying systems for boiler rooms with oil fired boilers and engine rooms with oil engines or gas turbines are to be provided with spraying nozzles of an approved type.

3.8.2 The number and arrangement of the nozzles is to be to the satisfaction of the Surveyor, and such as to ensure an effective distribution of water in the spaces to be protected. Nozzles are to be fitted above bilges, tank tops and other areas over which fuel oil is liable to spread and also above fuel oil settling and service tanks, heaters, pumping units, purifiers and other main fire hazards in the boiler and engine rooms.

3.8.3 The system may be divided into sections, the distribution manifolds of which are to be operated from easily accessible positions outside the spaces to be protected and which will not be readily cut-off by an outbreak of fire.

3.8.4 The system is to be kept charged at the necessary pressure and the pump supplying the water for the system is to be put automatically into action by a pressure drop in the system.

3.8.5 The pump is to be capable of simultaneously supplying at the necessary pressure all sections of the system in any one compartment to be protected. The pump and its controls are to be installed outside the space or spaces to be protected. It must not be possible for a fire in the space or spaces protected by the water-spraying system to put the system out of action.

3.8.6 Special precautions are to be taken to prevent the nozzles from becoming clogged by impurities in the water or corrosion of piping, nozzles, valves and pump.

3.9 Closing of openings and control of fans

3.9.1 Provision is to be made for closing all openings which might admit air to machinery spaces and to other spaces where there is risk of an oil fire. Skylights and ventilators of machinery spaces are to be capable of being shut from the deck or from a safe position outside these spaces. Provision is to be made for rapidly stopping all fans from positions outside such spaces.

3.10 Precautions relating to oil leakage and outbreaks of fire

3.10.1 Gutterways are to be arranged at the foot of bulkheads in boiler rooms to ensure that leakage shall have free drainage to the wells or limbers.

3.10.2 Drip trays or gutterways with suitable draining arrangements are to be provided for all tanks which do not form part of the hull structure, at pumps, valves and elsewhere where there is a possibility of leakage. Drip trays are also to be fitted under oiltight decks, except if these are completely welded, when drip trays need only be fitted over the boilers.

3.10.3 If stores are carried in a compartment adjacent to a fuel oil settling tank which may be heated, the compartment side of the bulkhead or deck is to be insulated or equivalent arrangements provided.

3.10.4 In machinery spaces, two means of escape are to be provided from each engine room and boiler room. These are to be as widely separated as practicable.

■ *Section 4*
Fire pumps and water service pipes

4.1 General

4.1.1 All floating docks are to be provided with fire pumps, water service pipes, hydrants and hoses, complying in general with *Pt 2, Ch 3, 2 Pumps, water service pipes, hydrants and hoses*.

4.1.2 In floating docks of less than 200 tonnes lift, at least one fixed hand operated pump with a permanent sea suction and discharge to the fire main is to be provided. Floating docks of 200 tonnes lift and over but less than 1000 tonnes lift, are to be provided with one power pump and one fixed hand operated pump with a permanent sea suction and discharge to the fire main.

4.1.3 In floating docks of 1000 tonnes lift and over, not less than two independently driven power pumps are to be provided, preferably one pump being placed in each wing.

4.1.4 In addition, in floating docks of 2000 tonnes lift and over, if a fire in any one compartment could put all the pumps out of action there is to be an alternative means of providing water for fire-fighting. This alternative means is to be a fixed emergency pump independently driven by an engine, or other approved means. This emergency pump is to be capable of supplying two jets of water to the satisfaction of the Surveyor. The pump is to be located in a readily accessible position which is not likely to be rendered inaccessible by a fire in the compartment containing the main fire pumps. The pump is to be provided with its own sea suction and discharge to the fire main. A valve is to be provided for isolating the fire main outside the compartment containing the main fire pumps. This isolating valve is to be situated in a readily accessible position outside that compartment. However, if shore based fire-fighting appliances are readily available, consideration may be given to dispensing with the emergency pump. This will be at the discretion of the Committee.

4.2 Fire hydrants, hoses and nozzles

4.2.1 The number of fire-hoses to be provided, each complete with couplings and nozzles, is to be one for each 30 m length of each wing of the dock and one spare, but in no case less than a total of six (three on each wing) for floating docks of 1000 tonnes lift and over and not less than a total of four for smaller docks. These numbers do not include any hoses required in any engine or boiler room. If necessary, the number of hoses is to be increased to ensure that hoses in sufficient number are available and accessible at all times.

4.2.2 In accommodation, service and machinery spaces, the number and position of hydrants are to be such as to comply with the requirements of *Pt 2, Ch 3, 2.5 Number and position of hydrants*.

4.2.3 All hydrants in the machinery spaces of floating docks with oil fired boilers, oil engines or gas turbines are to be fitted with hoses having, in addition to the nozzles required by *Pt 2, Ch 3, 2.8 Nozzles*, nozzles suitable for spraying water on oil, or alternatively, dual purpose nozzles.

4.3 Portable fire-extinguishers in accommodation and service spaces

4.3.1 Radio rooms, accommodation and service spaces are to be provided with a sufficient number of portable fire-extinguishers to ensure that at least one extinguisher will be readily available for use in every compartment of the crew spaces to the Surveyor's satisfaction.

4.3.2 For galleys, and for spaces containing domestic boilers, one portable fire-extinguisher suitable for dealing with oil fires or fires in electric cooking equipment is to be provided.

4.4 Fire-extinguishing appliances in boiler rooms, etc.

4.4.1 In spaces where oil fired boilers exceeding 3,5 kg/cm^2 are situated, or in spaces containing fuel oil units or settling tanks in floating docks exceeding 1000 tonnes lift, any one of the following types of fixed fire-extinguishing installations complying with *Pt 2, Ch 3, 3 Fire detection and fire-extinguishing systems and equipment* is to be provided:

(a) a pressurized water-spraying system;
(b) a fire-smothering gas installation;
(c) a fixed froth installation supplemented, if necessary, by a fixed or mobile arrangement for pressurized water or froth spraying to fight fire above floor plates.

Floating docks that are not within the above category will be specially considered. The fixed installation is to be of type *Pt 2, Ch 3, 4.4 Fire-extinguishing appliances in boiler rooms, etc. 4.4.1.(b)* in all cases where the flash point of the fuel oil is less than 60ºC (closed cup test). In each case, if the engine and boiler rooms are not entirely separate, or if fuel oil can drain from the boiler room into the engine room bilges, the combined engine and boiler rooms are to be considered as one compartment.

4.4.2 There are to be at least two approved portable extinguishers discharging froth, or other approved medium suitable for extinguishing oil fires, in each firing space in each boiler room and each space in which a part of the fuel oil installation is situated. In addition, there is to be at least one extinguisher of the same description with a capacity of 9 litres for each burner, provided that the total capacity of the additional extinguisher or extinguishers need not exceed 45 litres of any one boiler room.

4.4.3 In each firing space there is to be a receptacle containing at least 0,28 m^3 of sand, sawdust impregnated with soda, or other approved dry material and a scoop for distributing this material. Alternatively, an approved portable extinguisher may be substituted therein.

4.5 Fire-fighting appliances in spaces containing engines or gas turbines

4.5.1 Where engines or gas turbines are used, with a total power not less than 1000 bhp, floating docks of 1000 tonnes lift and over are to be provided with the following arrangements *Pt 2, Ch 3, 4.5 Fire-fighting appliances in spaces containing engines or gas turbines 4.5.1* and *Pt 2, Ch 3, 4.5 Fire-fighting appliances in spaces containing engines or gas turbines 4.5.1.(b)*, and floating docks of under 1000 tonnes lift with arrangement *Pt 2, Ch 3, 4.5 Fire-fighting appliances in spaces containing engines or gas turbines 4.5.1.(b)*. For docks of under 200 tonnes lift the provision of a 45 litre extinguisher may be waived:

(a) There is to be one of the fixed arrangements required by *Pt 2, Ch 3, 4.4 Fire-extinguishing appliances in boiler rooms, etc. 4.4.1*.
(b) There is to be in each engine space one approved froth type extinguisher of not less than 45 litres capacity or equivalent, and also one approved portable froth extinguisher for each 1000 bhp of the engines or part thereof; but the total number of portable extinguishers so supplied is not to be less than two and need not exceed six.

Section 5
Fire protection

5.1 General

5.1.1 The caissons, pontoons, wing walls, super structures, bulkheads, decks and deckhouses are to be of steel or other material which, by itself or due to insulation provided, has structural and fire integrity properties equivalent to steel.

5.1.2 Pipes conveying oil or combustible liquids are to be of approved material having regard to the fire-risk. Materials readily rendered ineffective by heat are not to be used for overboard scuppers, sanitary discharges and other outlets which are close to the waterline and where the failure of the material in the event of fire would give rise to dangers of flooding.

5.1.3 All internal bulkheads, ceilings and linings shall be constructed of non-combustible materials. Corridor bulkheads shall be constructed of steel or to 'B' Class standards. All exposed surfaces in corridors and stair-way enclosures and surfaces in concealed or inaccessible spaces should have low flame-spread characteristics. Bulkheads, linings and ceilings may have combustible veneer, provided that such veneer should not exceed 2,0 mm within any such space except corridors, stairway enclosures and control stations, where it should not exceed 1,5 mm. Paints, varnishes and other finishes used on exposed interior surfaces should not be of a nature to offer an undue fire hazard. Bulkheads of galley, paint stores, lamp rooms and other compartments containing materials which would constitute a similar fire hazard are to be of steel or equivalent material. Deck coverings within accommodation spaces on the decks forming the crown of machinery spaces are to be of a type which will not readily ignite.

Section
1 General requirements

Section 1
General requirements

1.1 General

1.1.1 Items of machinery, such as boilers, pressure vessels, auxiliary engines, compressors, pumps, etc. essential to the safety and operation of a floating dock are to be constructed and installed in general accordance with the relevant requirements of the *Rules and Regulations for the Classification of Ships, July 2021* (hereinafter referred to as the Rules for Ships).

1.1.2 Pumping arrangements, fuel oil and other piping systems are to be provided in accordance with the Rules for Ships so far as they may be applicable to floating docks.

1.1.3 The arrangements for discharging water ballast are to be such that not less than two pumps are available for pumping out each buoyancy compartment.

1.2 Electrical installations

1.2.1 Electrical equipment constructed in accordance with the Rules for Ships will be accepted. Alternatively, consideration will be given to the acceptance of equipment constructed in accordance with National or International standard for industrial equipment. In the latter case, due consideration is to be given to the ambient temperature and other ambient conditions expected in service, and the necessary adjustments made to such items as permissible temperature rise.

1.2.2 In all other respects, e.g. the system of distribution, the installation is to comply with normal good electrical engineering practice, and *Pt 6, Ch 2, 1 General requirements* and *Pt 6, Ch 2, 2 Main source of electrical power* of the Rules for Ships is to be used as a guide for this purpose.

1.2.3 The following surveys are to be carried out in accordance with *Pt 6, Ch 2, 1 General requirements* and *Pt 6, Ch 2, 2 Main source of electrical power* of the Rules for Ships:

(a) inspection and testing of electrical equipment;
(b) installation of electrical equipment;
(c) final testing of the electrical installation.

1.3 Control engineering systems

1.3.1 Control, alarm and safety systems are to be in accordance with *Pt 6, Ch 1 Control Engineering Systems* of the Rules for Ships insofar as they may be applicable to floating docks.

1.4 Plans

1.4.1 Plans of machinery, as required by the Rules for Ships, so far as these are applicable to floating docks, are to be submitted for approval before work is commenced.

Published by Lloyd’s Register Group Limited
Registered office (Reg. no. 08126909)
71 Fenchurch Street, London, EC3M 4BS
United Kingdom